The Prevalence and Psychosocial Correlates of Non-suicidal Self-injury Among Chinese Adolescents in Hong Kong

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Abstract of thesis entitled:

The Prevalence and Psychosocial Correlates of Non-suicidal Self-injury Among Chinese Adolescents in Hong Kong

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Objective: Non-suicidal self-injury (NSSI) among adolescents has become one of the leading public health concerns and attracted increased research attention in recent years. The phenomenology of NSSI and the underlying mechanism, however, are still unclear. The present study examined the prevalence and psychological correlates of NSSI among Chinese community adolescents in Hong Kong. **Method:** Subjects, 4,782 Chinese adolescents (68.5% girls, aged between 11 and 19 years), were tested twice in two consecutive years. Participants completed measures assessing NSSI, mood lability, depression, impulsivity, self-identity disturbances, interpersonal disturbances and dissociative symptoms in class. **Results:** Findings revealed that 15.0% of participants have engaged in NSSI within the past two years. Among different NSSI behaviors, cutting, biting and self-hitting were the most prevalent and burning was the least. Gender differences on specific NSSI methods were also observed. Among all psychological correlates, behavioral impulsivity was the most important predictors for NSSI. Among the three types of impulsive behaviors, substance use captured the largest amount of unique variance in NSSI and it was also the most powerful predictor of future NSSI. Path analysis revealed that NSSI was most likely triggered in the context of unstable relationship, and behavioral impulsivity exerted a significant moderating effect on the development of NSSI. **Discussion:** Implications for classification issues of NSSI in DSM system and treatment strategies were discussed.

摘　要

目的：非自殺性自我傷害 （Non-suicidal self-injury, 簡稱 NSSI）是青少年中主要的公共健康問題，在近年來吸引了越來越多的研究注意。然而，NSSI 的現象學特徵和背後的機制卻仍不明朗。本研究旨在調查 NSSI 在香港華人社區青少年中的發生率及與之相關的心理學變量。**方法：**被試，共有 4，782 名青少年（女性 68.5%，年齡在 11 到 19 歲）連續兩年接受了調查。被試在課堂上完成了對 NSSI，情緒不穩定性，抑鬱，衝動性，自我認知混亂，人際關係矛盾，以及分離性症狀的測量。 **結果：**研究發現 15%的青少年曾在過去兩年中進行過 NSSI。在不同的 NSSI 行爲中，割傷、咬傷和打傷自己是最普遍的行爲，燒傷自己是最少發生的行爲。在不同的 NSSI 行爲上也存在顯著的性別差異。在所有相關的心理學變量中，行爲衝動性是 NSSI 最重要的預測因子。在三種不同類型的衝動性行爲中，物質濫用能夠獨立解釋 NSSI 最大的變異。同時，物質濫用也是預測未來 NSSI 行爲的最強有力的因素。另外，路徑分析顯示 NSSI 最有可能在不穩定的人際關係的情境中被激發，而行爲衝動性在 NSSI 的發展中起到了顯著的調節作用。**討論：**本研究將探討 NSSI 在 DSM 系統中的分類問題以及相應的治療策略。

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INTRODUCTION

Definition of Non-suicidal Self-injurious Behavior

Non-suicidal self-injury (NSSI) refers to "deliberate infliction or direct physical harm to one's own body without conscious suicidal intent" (Simeon & Favazza, 2001, p.1). The word "deliberate" emphasizes conscious intent rather than unconsciously driven or accidental acts. "Without conscious suicidal intent" means individuals committing these acts do not actually want to kill themselves, at least not at that moment, even though their actions result in physical injury.

NSSI among adolescents have attracted increased research attention in recent years for several reasons. First, NSSI often begins in early adolescence (van der Kolk, Perry, & Herman, 1991) and there is evidence that it is on the rise among adolescents in the West (Hawton, Fagg, Simkin, Bale, & Bond, 1997). Second, adolescent suicide accounts for at least 100,000 annual deaths in young people worldwide, and ranked as the third leading cause of death among adolescents in the United States (Rathus, Miller, & Campbell, 2008). Research indicated that NSSI is a potent predictor of suicide attempts in adolescents (Esposito, Spirito, Boergers, & Daonalson, 2003; Jenkins, Hale, Papanastassiou, Crawford, & Tyrer, 2002; Muehlenkamp & Guiterrez, 2007). Understanding the nature of NSSI, therefore, may provide important insight in prevention and early intervention of suicide. Third, NSSI arouses intense negative reactions from both clinicians and the general public and can have significant negative interpersonal consequences (Gratz, 2003). In fact, some clinicians (e.g., Linehan, 1993) consider NSSI as a significant therapy-interfering behavior and much clinical research effort has been devoted in understanding and treating this behavior.

Prevalence and Correlates of NSSI among Community Adolescents

Many studies on NSSI among adolescent and adult psychiatric samples have been reported. Findings from clinical samples, however, may not be generalized to the general population at large as the majority of individuals who self-injure do not seek help (Whitlock et al., 2006). To gain a more thorough understanding of NSSI, research among community adolescent samples is informative. Eighteen studies examining NSSI among community adolescent samples can be located. Table 1 summarizes main findings of these 18 studies in chronological order.

Garrison et al. (1993) assessed the 12-month prevalence of "nonsuicidal physically self-damaging acts" among 3,283 12-14 year-old high school students in the US. Self-damaging acts in this study included self-cutting, burning, hitting, interfering with wound healing and bone breaking. Prevalence estimation was based on diagnostic interviews after self-report screening. An overall 12-month prevalence rate of 2.5% was reported, with no significant gender difference (2.46% in boys and 2.79% in girls). Logistic regression showed that suicidal ideation, major depression and negative life events significantly increased the risk of engaging in NSSI.

Patton et al. (1997) examined the 12-month prevalence of "deliberate self-harm" (DSH) among 1,699 (53% girls) 15-16 year-old Australian secondary school students. DSH in this study included four types of behaviors: 1) self-laceration included cutting, piercing, and burning; 2) self-poisoning included deliberate overdose on therapeutic medication or consumption of other potentially toxic substances; 3) deliberate recklessness included risk taking with cars and trains, jumping from heights and reckless overuse of illicit drugs; and 4) self-battery included beating fists and hands into walls and other objects with evidence of significant bruising or cutting. The overall prevalence estimate was 5.1%, and girls reported significant

Table 1

Summary of the 18 studies on community adolescents of non-suicidal self-injury

Study	Term	Behaviors Included	Estimation Method	Sample size (% girls)	Overall Prevalence	Overall Gender Difference*	Psychological Correlates
Garrison et al. (1993)	Nonsuicidal physically self-damaging act	a, b, d, i, j, k	self-report + interview	3,283	12-moth: 2.5%	No	suicidal ideation, major depression and undesirable life events.
Patton et al. (1997)	deliberate self-harm	a, b, e, k, n, o	self-report	1,699 (53)	12-month: 5.1%	Yes	More depressive and anxiety symptoms, frequent antisocial behaviors, weekly marijuana use and being sexually active
Hawton et al. (2002)	deliberate self-harm	a, k, n, o, p	Self-report	6,020 (46.7)	lifetime: 13.0% 12-month: 6.6%;	Yes	self-harm in friends and family members, drug use, depression, anxiety, impulsivity and low self-esteem
Ross and Heath (2002)	self-mutilation	a, b, c, d, e, f, g	self-report + interview	440 (50.2)	lifetime: 13.9%	Yes	anxiety and depressive symptoms.
Zoroglu et al. (2003)	self-mutilation	a, b, d, e, i, q	self-report	839 (61.1)	lifetime: 21.4%	No	dissociative experience, neglect, physical, emotional and sexual abuse
De Leo and Heller (2004)	deliberate self-harm	a, k, n, o, p	self-report	3,757 (47.9)	lifetime: 12.4% 12-month: 6.2%	Yes	self-harm in friends or family members, smoking, amphetamine use, low self-esteem, boyfriend/girlfriend problems, self-prescribing medication, self-blaming and other distressing events
Muehlenkamp and Gutierrez (2004)	self-injuries behavior	a, b, d, e, f, k, n	self-report	390 (54.9)	lifetime: 15.9%	No	More depressive symptoms, suicidal ideation; greater repulsion by life, attraction to death and lower attraction to life.
Laye-Gindhu and Schonert-Reichl (2005)	non-suicidal self-harm	a, c, d, f, h, k, o	self-report	424 (55.7)	lifetime: 15.1%	Yes	emotional distress, antisocial behavior, anger control problem, anger discomfort and negative self-esteem
Lloyd-Richardson et al. (2007)	non-suicidal self-injury	a, b, c, d, h, i, l	self-report	633 (57)	12-month: 46.5%	Not reported.	suicide ideation

Table 1 (Continued)

Study	Term	Behaviors Included	Estimation Method	Sample size (% girls)	Overall Prevalence	Overall Gender Difference*	Psychological Correlates
Lundh, Karim and Quilisch (2007)	deliberate self-harm	a, b, c, d, e, f, j, k, l, m, q	self-report	128 (37.5)	lifetime: 65.9%	No	Low self-esteem and mindful attention awareness
Muehlenkamp and Gutierrez (2007)	non-suicidal self-injury	a, b, d, e, f, k, n	self-report	540 (62.3)	lifetime: 16.1%	No	greater level of depression and suicide ideation, and fewer reasons for living
Patton et al. (2007)	deliberate self-harm	a, b, e, k, n, o	self-report	3,332 (51)	12-month: 3.7%	Yes	late puberty, more depressive symptoms, frequent alcohol use and early sexual activity
Rossow et al. (2007)	deliberate self-harm	a, k, n, o, p	self-report	30,532 (48.7)	12-month: 5.7%	Yes	some or numerous episodes of intoxication
Wong et al. (2007)	non-suicidal self-injury	a, b, k, n	self-report	1,361 (34.4)	12-month: 3.8%	No	more anxiety and depressive symptoms, frequent substance use, more life stress, and undesirable family relationship
Hilt and Cha (2008)	non-suicidal self-injury	a, b, c, d, h, i, l	self-report	94 girls	lifetime: 56.4%; 12-month: 36.2%		more depressive symptoms and peer victimization
Hilt et al. (2008)	non-suicidal self-injury	a, b, d, i, q	self-report	508 (51)	12-month: 7.5%	No	smoking, taking drugs, engaging in maladaptive eating behaviors and lower parental relationship
Sun et al. (2008)	self-injuries behavior	a, e, g, p	self-report	10,894 (47.7)	12-month: 22.3%	No	low self-concept, overprotection, over-intervention, refuse and deny by mothers, and more psychological symptoms
Yates and Tracy (2008)	non-suicidal self-injury	a, b, c, d, h, i, l	self-report	1281 (52.2)	12-month: 35.0%	Yes	parental alienation

Note. a = cutting; b = burning; c = biting; d = hitting or punching; e = banging; f = scratching; g = pinching; h = poking; i = hair pulling; j = interfering with wound healing; k = reckless behavior (e.g. jumping, bone breaking); l = erasing or rubbing skin; m = dripping acid onto the skin; n = overdose; o = substance abuse; p = ingesting non-ingestible objects; q = others but not specify.

* "Yes" in this column indicates that girls were more likely to engage in NSSI.

higher overall rates (6.4% in girls vs. 4.0% in boys). Among the self-harmers, about 30% reported at least two previous episodes of DSH with little difference in rates of repetition across subtypes. In this study, self-cutting was estimated to be present among 1.7% of the sample, and was more prevalent in girls (2.6%) than in boys (0.7%). The rate for self-battery was 0.7%, with no significant gender difference (0.4% in girls vs. 1.1% in boys). Concerning psychological correlates, this study found that depressive and anxiety symptoms, and sexual activity were positively associated with DSH in both genders, as well as with repetition of DSH. Antisocial behaviors and substance abuse were positively associated with DSH only in girls but not boys.

Hawton, Rodham, Evans, and Weatherall (2002) examined the prevalence of the following four subtypes of "deliberate self-harm" behaviors using self-report questionnaire: 1) Initiated behaviors (e.g. self-cutting, jumping from heights); 2) Ingesting a substance in excess of the prescribed or generally recognized therapeutic dose; 3) Ingesting a recreational or illicit drug that was an act that the person regarded as self-harm; and 4) Ingesting a non-ingestible substance or object. Among a sample of 6,020 (46.7% girls) British school adolescents, aged between 15 and 16 years, the overall lifetime prevalence was 13.0%; and 12-month prevalence was 6.6%, with significantly more girls (10.6%) engaging in DSH than boys (3.1%). The main method used was cutting, with a 12-month prevalence rate of 4.3%. Also, multiple acts of DSH were reported by 54.8% of the self-harmers. Using logistic regression analyses, Hawton et al. (2002) found that DSH in friends or family members, drug use and low self-esteem were significantly associated with DSH in both genders, whereas depression, anxiety and impulsivity were associated with DSH only in girls.

Ross and Heath (2002) examined the lifetime prevalence of "self-mutilation" among 440 (50.2% girls) Canadian high school students with a mean age of 14.5 years. Self-mutilation in this study included self-cutting, burning, scratching, hitting, biting, pinching, and banging the wall. Students who indicated that they hurt themselves on purpose also participated in a follow-up interview. Based on interviews, it was found that 13.9% of all students reported having engaged in self-mutilation at some time, and girls reported significantly higher rates than boys (17.7% vs. 10.1%, respectively). Self-cutting was the most common method (with a prevalence rate of 5.7%), followed by hitting (4.6%), banging (2.5%), pinching (1.0%), scratching (0.7%), biting (0.7%) and burning (0.5%). Moreover, students who self-mutilated reported significantly more anxiety and depressive symptoms than those who did not.

Zoroglu et al. (2003) examined lifetime prevalence of "self-mutilation" among 832 (61.1% girls) Turkish high school students, aged between 14-17 years, using self-report questionnaires. In this study, self-mutilation included cutting, slashing, burning, hair pulling, banging and hitting body areas. Overall, self-mutilation was found in 21.4% of the sample, with similar rates between girls (21.5%) and boys (21.3%). The most frequent type was banging and hitting body areas (11.3%), followed by cutting (8.4%), hair pulling (4.3%) and burning (2.1%). Hair pulling was significantly more frequent in girls (5.8%) than in boys (1.9%), and the remaining types of self-mutilation were very similar in both genders. Moreover, physical, emotional and sexual abuse, neglect, and dissociative experience were found to significantly increase the risk of self-mutilation.

Using the same operational definition of "deliberate self-harm" as that in Hawton et al.'s (2002) study, De Leo and Heller (2004) studied DSH among a

sample of 3,757 (47.9% girls) Australian high school students (with a mean age of 15.4 years) and found an overall lifetime prevalence of 12.4%, and a 12-month prevalence of 6.2%. Significantly more girls (11.1%) self-harmed in the previous year as compared to boys (1.6%). Cutting was the most common method, endorsed by 3.7% of the total sample, whereas self-battery was only reported by 0.1% of the total sample. Factors that were found to be associated with DSH were similar behaviors in friends or family, coping by self-blame, low self-esteem, substance use, and use of self-prescribing medications.

Muehlenkamp and Gutierrez (2004) studied "self-injurious behaviors" (SIBs) among a sample of 390 (54.9% girls) American high school students (with a mean age of 16.27) using self-report questionnaires. In this study, SIBs included self-cutting, scratching, burning, self-hitting, punching/kicking, banging, and others such as hanging, jumping from high places and overdose. An overall lifetime prevalence of SIBs was reported to be 15.9%, with no significant gender difference (13.1% in girls and 19.3% in boys). Self-cutting was the most prevalent method (7.4%), followed by scratching (4.4%), self-hitting (2.1%), burning (1.3%) and punching/kicking (0.8%). Among self-injurers, 24% used multiple methods. Depression, suicidal ideation and negative attitudes towards life significantly predicted participants' self-harm category (i.e., SIB only, suicide attempt, no self-harm).

Laye-Gindhu and Schonert-Reichl (2005) studied "nonsuicidal self-harm" behaviors in a sample of 424 (55.7% girls) Canadian high school adolescents (aged between 13-18 years). They classified "nonsuicidal self-harm" behaviors into 6 non-mutually-exclusive categories based on participants' self-report. The 6 categories were (1) cutting-type behaviors (e.g., scratching, poking), (2) hitting or

biting self, (3) abusing pills, (4) disordered eating behavior, (5) reckless behavior and bone breaking, and (6) falling/jumping. The overall lifetime prevalence was estimated to be 15.1%. Even after excluding behaviors that do not lead to immediate and visible injury (i.e., eating disorders), still 13.2% of the total sample reported harming themselves intentionally, and the prevalence rate was twofold in girls (16.9%) than in boys (8.5%). Cutting-type behaviors were again the most common method (6.6%), followed by self-hitting or biting (4.0%). Significantly increased antisocial behavior, emotional distress, anger problems, health risk behaviors and decreased self-esteem were found among adolescents who indicated harming themselves.

Lloyd-Richardson et al. (2007) examined "non-suicidal self-injury (NSSI)" with the Functional Assessment of Self-Mutilation (FASM, Lloyd, et al., 1997) among 633 (57% girls) American high school adolescents (grades 9-12, mean age = 15.5 years). FASM included 11 different NSSI behaviors which can be classified into two categories in terms of their degree of severity. This classification was based on a principal components analysis (Lloyd, et al., 1997). The two categories were: 1) moderate/severe NSSI, including cutting or carving skin, burning, self-tattooing, scraping, and erasing skin; and 2) minor NSSI, including self-hitting, hair pulling, biting, inserting objects under skin or nails, picking at a wound and picking areas to draw blood. Since 44% of all participants endorsed the item "picked at a wound", suggesting that this may be a clinically insignificant behavior among adolescents, the researchers eliminated those who endorsed only this item from further analyses. The overall 12-month prevalence rate was estimated to be 46.5%, with self-biting being the most frequent method (16.1%), followed by cutting (13.9%), burning (12.0%), and hitting (11.5%). Gender difference was not reported in this study. Concerning the

frequency of NSSI, an average of 12.9 incidents (*SD* = 29.4, median = 4.0, mode = 2.0, range = 1-205) was reported. The majority of self-injurers reported multiple episodes. The mean number of types of NSSI performed was 2.4 (*SD* = 1.7, median = 2.0, mode = 1.0, range = 1-10). About 42% of self-injurers reported engaging in only one type of NSSI in the past year, while 52% endorsed engaging in 2 to 5 types of NSSI, and 6% reported 6 or more different types of NSSI. Moderate/severe self-injurers were more likely than minor self-injurers, who in turn were more likely than non-injurers, to have a history of psychiatric treatment, hospitalization and suicide attempt, as well as current suicidal ideation.

Lundh, Karim, and Quilisch (2007) investigated the lifetime prevalence rate of "deliberate self-harm" behaviors among 128 (37.5% girls) 15-year-old Swedish school adolescents. They used a short version of the Deliberate Self-Harm Inventory (DSHI; Gratz, 2001) which assessed 14 behaviors including self-cutting, burning, carving, scratching, scrubbing, biting, punching, banging, rubbing sandpaper or glass onto the skin, dripping acid onto the skin, sticking sharp objects into the skin, bone breaking, and preventing wounds from healing. Results showed that 65.9% of adolescents reported having engaged in some kind of DSH at least once; 41.5% reported at least one kind of DSH more than once; and 13.8% reported at least one form of DSH "many times". No overall gender differences in DSH were found between girls (61.7%) and boys (68.4%). The most prevalent types of DSH were cutting-type behaviors, i.e., sticking sharp objects into the skin (32.5%), carving (24.4%), and cutting (17.9%); as well as hitting-type behaviors, i.e., punching (23.6%) and banging (22.8%). Other common types were preventing wounds from healing (25.2%), scratching (20.3%) and burning (17.1%). Cutting was significantly more frequent among girls than boys (34.0% vs. 7.9%, respectively), so was rubbing

glass into the skin (8.6% vs. 0%, respectively). Comparing repeaters of DSH (engaging in DSH more than once) and non-repeaters, low self-esteem and low mindfulness were found to be associated with high rates of DSH.

Muehlenkamp and Gutierrez (2007) conducted a similar study as their previous study (Muehlenkamp & Gutierrez, 2004) among 540 (62.3% girls) American high school students (with a mean age of 15.53 years). In this study, they included the same set of behaviors but used a different term, i.e., "non-suicidal self-injury". The overall lifetime prevalence was reported to be 16.1%, with similar rates between girls (15.5%) and boys (17.1%). Self-cutting was again the most common method (8.9%), followed by scratching (6.7%), self-hitting (2.8%), punching/kicking (1.7%), burning (0.9%), and banging (0.6%). Among those reporting NSSI behavior, 70.1% reported using only 1 method, and 19.5% reported using more than 1 method (10.4% did not report the number of methods they used). Compared to non-self-injurers, those who engaged in NSSI reported significantly higher level of depression and suicidal ideation, and fewer reasons for living.

Patton et al. (2007) conducted another study to examine the prevalence and correlates of "deliberate self-harm" in a sample of 3,332 high school students (51% girls, aged between 11.8 and 16 years) from the United States and Australia. The same operational definition of DSH as in their previous study (Patton et al., 1997) was used. Overall, the 12-month prevalence rate was reported to be 3.7%, with DSH being more prevalent in girls than in boys (5.0% vs. 2.2%, respectively). Self-laceration was the most common type, reported by 2.2% of all participants, and it was more prevalent in girls (2.8%) than in boys (1.1%). Higher rates of depressive symptoms, frequent alcohol use, and early sexual activity were significantly associated with DSH.

Rossow et al. (2007) studied "deliberate self-harm" among 30,532 (48.7% girls) high school students (primarily aged 15 and 16 years) from seven countries: Australia, Belgium, England, Hungary, Ireland, Netherlands and Norway. They adopted the definition of DSH as that in Hawton et al.'s (2002) study. An overall 12-month prevalence rate was reported to be 5.7%, with significantly more girls having engaged in DSH than boys (8.8% vs. 2.6%, respectively). In all countries, moderate and heavy drinkers were found to have a significantly elevated risk of DSH than abstainers.

Wong, Stewart, Ho and Lam (2007) examined "non-suicidal self-injury" behavior among 1,361 (34.4% girls) Chinese high school students (aged 12 to 17 years) in Hong Kong. NSSI in this study included three kinds of behaviors: 1) cutting, piercing or burning; 2) overdosing on therapeutic medication or ingesting other toxic substances; and 3) reckless behaviors such as jumping from cars. An overall 12-month prevalence rate of 3.8% was obtained, with similar rates between girls (4.3%) and boys (3.6%). Higher levels of anxiety and depressive symptoms, frequent substance use, more life stress and undesirable family relationship were found to be associated with NSSI.

Hilt and Cha (2008) used the same operational definition of NSSI as that in Lloyd-Richardson et al.'s (2007) study and examined the prevalence of 10 types of NSSI among 94 American community adolescent girls (aged 10 to 14 years). An overall lifetime prevalence of 56.4% and 12-month prevalence of 36.2% were reported. The prevalence rate regarding to individual types of NSSI was not provided. The small sample size and biased sample recruited from school and community advertisement may partly account for the higher prevalence rate as compared to those in other similar studies. Depressive symptoms were associated with engaging in

NSSI, and rumination moderated this relationship. Interpersonal distress was also associated with NSSI, and this relationship was moderated by the quality of peer communication.

Hilt, Nock, Lloyd-Richardson and Prinstein (2008) examined "nonsuicidal self-injury" among 508 (51% girls) American high school students (grades 6-8). In this study, NSSI included only self-cutting, burning, hitting, hair pulling and others which were not specified. An overall 12-month prevalence rate was reported to be 7.5%, with no significant differences across genders. The prevalence rates with regard to specific types of NSSI were not reported. Those engaging in NSSI were more likely to report having smoked cigarettes, taken drugs, and engaged in maladaptive eating behaviors. Self-injurers also suffered lower quality of relationships with their parents.

Sun et al. (2008) examined "self-injurious behavior" in a sample of 10,894 (47.7% girls) Chinese high school students (aged 13 to 20 years) in rural areas in mainland China using self-report questionnaires. In this study, self-injurious behaviors included head banging, pinching, ingesting non-ingestible objects, cutting wrist and other skin areas, and mutilating fingers/toes. An overall 12-month prevalence rate of 22.3% was obtained, with slightly more girls reporting self-injurious behaviors than boys (23.5% vs. 21.1%, respectively). In this study, 15.0% of all participants were classified as occasional self-injurers (conducting self-injuries behaviors once to thrice in the previous year), and 7.3% were classified as repetitive self-injurers (conducting self-injuries four to six times in the previous year). The most common method was pinching, present in 17.0% of all participants, followed by banging (7.1%) and cutting skin (6.8%). Cutting wrist (2.5%) and mutilating fingers/toes (2.1%) were the least common methods. Logistic regression

showed that the main risk factors for self-injurious behaviors were higher level of psychiatric symptoms, mothers' parenting style of over-protection, over-intervention, invalidation and low self-concept. Fathers' emotional warmth and understanding, on the other hand, acted as a protective factor.

Yates and Tracy (2008) studied "nonsuicidal self-injury" among both a 1,036 (51.9% girls) cross-sectional sample (grades 9-12) and a 245 (53.1% girls) longitudinal sample (assessed from 6th grade to 12th grade; NSSI was assessed only in the 12th grade). They included the same behaviors as those in Lloyd-Richardson et al.'s (2007) study. Combining both samples, an overall 12-month prevalence of 35.0% was reported, with girls reporting significantly higher rates of NSSI than boys (39.3% vs. 30.3%, respectively). Of all participants, 8.2% reported one incident of NSSI in the preceding year, and 26.9% reported more than one incident. The most prevalent method was self-hitting, endorsed by 16.7% of all participants, followed by picking body areas to bleed (14.3%), cutting or carving skin (12.9%), scraping to bleed (10.5%), and biting (10.2%). Using the zero-inflated poisson regression models among both the cross-sectional and longitudinal samples, parental criticism was associated with the probability of NSSI among both genders, and with the frequency of NSSI only among boys, and youth alienation toward parents emerged as a mediator underlying these pathways.

What Can We Learn About NSSI among Adolescents from Previous Studies?

NSSI are relatively common among nonclinical adolescents worldwide

Previous studies on NSSI among nonclinical adolescents used different terms such as "nonsuicidal physically self-damaging act" (Garrison et al., 1993), "deliberate

self-harm" (e.g., Patton et al., 1997; Patton et al., 2007), "self-mutilation" (Ross & Heath, 2002; Zoroglu et al., 2003), or "nonsuicidal self-injury" (e.g., Lloyd-Richardson et al., 2007; Muehlenkamp & Gutierrez, 2007), and varied in their operational definitions of NSSI. Close examination of these studies reveals that they can be roughly divided into two groups. One group (9 studies) adopted a relatively broad conceptualization of NSSI in their studies and included, besides typical physical NSSI, a wide variety of self-damaging acts such as self-poisoning, reckless drug use, ingesting a non-ingestible substance, or jumping from heights. The other nine studies adopted a more specific definition of NSSI and examined mainly the narrowly defined nonsuicidal, physical self-injurious behaviors. Moreover, different studies used different methodologies in assessing NSSI. Some studies used only one screening item and asked participants to provide detailed information on their NSSI (e.g., Patton et al., 1997; Patton et al., 2007), other studies used cued listing method and provided subjects with checklists which included different numbers of NSSI (e.g., 10 NSSI in Lloyd-Richardson et al.'s study and 15 NSSI in Lundh et al.'s study).

Different operational definitions and different methodologies in assessing NSSI across studies resulted in huge variation in prevalence estimates of NSSI among nonclinical adolescents. The lifetime prevalence rates of NSSI varied from 12.4% to 65.9%, and the 12-month prevalence rates varied from 2.5% to 46.5%. Based on these findings, it is difficult to reach a definite conclusion about the overall prevalence rates of NSSI among nonclinical adolescents. One approach to get a more accurate estimate of these behaviors among community adolescents would be to focus just on the prevalence rates of each specific NSSI. Table 2 summarizes available findings on the prevalence rates of the five most commonly examined NSSI in previous studies, i.e., self-cutting, burning, biting, self-hitting/ punching, and

banging. Even with this more specific approach, prevalence figures of specific NSSI among adolescents still varied across studies, albeit with much less variation.

Despite the uncertain prevalence estimates of NSSI among nonclinical adolescents, findings from the previous studies do indicate that a significant number of adolescents worldwide engaged in various NSSI. Consistency across studies regarding the most common types of NSSI is relatively high. The most common NSSI among adolescents include cutting, burning, hitting/punching, banging and biting. Cutting was reported as the most often used method in nine of these studies, and among the top three methods in another four studies. Self-hitting/punching was also among the top three methods in seven studies. To enhance our understanding of these behaviors among adolescents, future research should report both the overall prevalence and individual prevalence rates of different NSSI behaviors.

Possible subtypes of self-injurers

Most researchers studying NSSI considered all self-injurers as a homogeneous group and compared overall differences on psychosocial functioning between self-injurers and non-self-injurers. Few studies have examined the possible existence of different subtypes of self-injurers who may differ from each other along some important psychological or behavioral dimensions.

Jacobson and Gould (2007) suggested that how frequent a person engages in NSSI is an important dimension that may be related to the degree of overall impairment or psychopathology within the individual. For example, repetitive self-injurers may suffer intolerable emotional pain and use NSSI as a coping strategy to take away their pain, while occasional self-injurers may just represent copy-cat

Table 2

Summary of Main Research Findings on Five Most Common Types of NSSI from Community Adolescent Studies

NSSI	No. of studies	Prevalence	Gender difference	References
Cutting	18	Lifetime: 5.7% to 17.9%; 12-month: 3.7% to 13.9%	2 studies found more common in girls, 1 found no difference, and 14 did not test	De Leo and Heller, 2004; Garrison et al.,1993; Hawton et al., 2002; Hilt et al., 2008; Hilt and Cha, 2008; Laye-Gindhu and Schonert-Reichl, 2005; Lloyd-Richardson et al., 2007; Lundh et al., 2007; Muehlenkamp and Gutierrez, 2004, 2007; Patton et al., 1997; Patton et al., 2007; Ross and Heath, 2002; Rossow et al., 2007; Wong et al., 2007; Sun et al., 2008; Yates and Tracy; 2008; Zoroglu et al., 2003
Burning	13	Lifetime: 0.5% to 17.1%; 12-month: 8.1% to 12.0%	2 studies found no difference, and 10 did not test	Garrison et al.,1993; Hilt et al., 2008; Hilt and Cha, 2008; Lloyd-Richardson et al., 2007; Lundh et al., 2007; Muehlenkamp and Gutierrez, 2004, 2007; Patton et al., 1997; Patton et al., 2007; Ross and Heath, 2002; Zoroglu et al., 2003; Wong et al., 2007; Yates and Tracy; 2008
Biting	6	Lifetime: 0.7% to 10.6%; 12-month: 10.2% to 16.1%	2 studies found no difference, and 3 did not test	Hilt and Cha, 2008; Laye-Gindhu and Schonert-Reichl, 2005; Lloyd-Richardson et al., 2007; Lundh et al., 2007; Ross and Heath, 2002; Yates and Tracy; 2008
Hitting/punching	11	Lifetime: 3.6% to 23.6%; 12-month: 11.5% to 16.7%	3 studies found no difference, and 7 did not test	Garrison et al.,1993; Hilt et al., 2008; Hilt and Cha, 2008; Laye-Gindhu and Schonert-Reichl, 2005; Lloyd-Richardson et al., 2007; Lundh et al., 2007; Muehlenkamp and Gutierrez, 2004, 2007; Ross and Heath, 2002; Yates and Tracy; 2008; Zoroglu et al., 2003
Banging	8	Lifetime: 0.6% to 22.8%; 12-month: 0.1% to 17.1%	2 studies found no difference, and 5 did not test	Lundh et al., 2007; Muehlenkamp and Gutierrez, 2004, 2007; Patton et al., 1997; Patton et al., 2007; Ross and Heath, 2002; Sun et al., 2008; Zoroglu et al., 2003

cases and deserve less clinical attention. Only three existing studies among community adolescents have examined the significance of frequency of NSSI (Lundh et al., 2007; Patton et al., 1997; Yates & Tracy, 2008). Findings suggest that repetitive self-injurers possessed lower self-esteem and mindful awareness ability (Lundh et al., 2007), experienced higher psychiatric morbidity, and exhibited more antisocial behaviors (Patton et al., 1997). Moreover, variables leading to the initiation of NSSI may be different from those perpetuating it (Yates & Tracy, 2008). Thus, frequency of NSSI may represent an important dimension that deserves further exploration in future studies.

Lloyd-Richardson et al. (2007) also attempted to differentiate NSSI in terms of their clinical severity. These researchers classified NSSI into two subtypes: moderate/severe NSSI vs. minor NSSI. The former included cutting and burning, and the latter included hitting, banging and biting. Self-injurers using moderate/severe NSSI experienced greater harm from their NSSI acts, received more treatment, and suffered more psychological distress than those who only engaged in minor NSSI. Furthermore, while the majority of self-injurers reported little forethought about their acts, moderate/severe self-injurers were more likely to contemplate NSSI before engaging in the behavior. In other words, minor NSSI users may be more impulsive in nature. These findings suggest that future research should pay more attention to the degrees of severity of different NSSI methods, and examine whether self-injurers using NSSI methods of different severity differ qualitatively in their psychological profiles.

Psychosocial correlates of NSSI among nonclinical adolescents

Previous studies have identified several psychosocial correlates of NSSI among non-clinical samples of adolescents. Within the family, a history of physical, emotional or sexual abuse (Zoroglu et al., 2003) and negative relationships with parents (Yates & Tracy, 2008) have been reported. Other correlates included life stress (De Leo & Heller, 2004; Garrison et al., 1993), and self-injury in friends and family members (De Leo & Heller, 2004; Hawton et al., 2002). Psychological correlates of NSSI included dysphoric mood, suicidal ideation, poor self-esteem, dissociative experience, anger, impulsivity, antisocial behavior and substance abuses (refer to Table 1). Most of these psychological correlates of NSSI, interestingly, closely resemble the core features of borderline personality disorder (BPD) which include mood dysregulation, impulse dyscontrol, self and cognitive disturbances, and disturbed interpersonal relationships (Leung & Zhong, 2006; Lieb et al., 2004).

NSSI is in fact considered as one of the most distinctive diagnostic features for BPD in the DSM system. Linehan (1993), in her biosocial theory of BPD, considered NSSI as a maladaptive coping behavior for BPD patients to deal with their unbearable emotional pain or cognitive disturbances. Emotionally, individuals with BPD are highly sensitive in their emotional reactivity and frequently experience intense dysphoric mood. It is postulated that BPD patients may use NSSI as a means to regulate their painful emotions. Cognitively, many BPD patients experience chronic feelings of emptiness and/or dissociation. NSSI may also serve as a means for BPD patients to end painful and confusing cognitive states. Behaviorally, BPD patients show marked impulsivity (e.g., irresponsible spending, promiscuity, fighting, alcohol and drug abuses). This tendency of impulse dyscontrol may make them more

prone to use NSSI, in an impulsive manner perhaps, to deal with their pain. Interpersonally, BPD patients often form intense and stormy relationships with others and have strong fear of abandonment. In the face of possible abandonment, BPD patients may resort to manipulative behaviors such as NSSI to prevent the other person from leaving the relationship. Taken together, these core features of BPD pathology may explain why NSSI is so frequently observed among BPD patients.

While the relationships between mood disturbances, behavioral impulsivity, cognitive disturbances, unstable relationships and NSSI have long been documented among BPD patients (e.g., Dulit, Fyer, Leon, Brodsky, & Frances, 1994; Zanarini et al., 2006; Zlotnick, Mattia, & Zimmerman, 1999), studies of NSSI in both BPD samples and non-clinical adolescent samples have seldom examined the differential predictive relationships between these psychological features and NSSI. It is unclear which of these psychological features may be more important in predicting NSSI, either in the BPD or non-clinical adolescent samples. It is also unclear how these psychological correlates and NSSI may be related to each other within a meaningful conceptual framework. Clarifying the differential predictive relationships between these psychological features and NSSI, and the potential causal relationships among them may help us develop a better understanding of the nature of NSSI in both BPD and non-clinical adolescent samples. This information is also important for identifying at risk adolescents and formulating appropriate clinical intervention strategies.

Purposes of the Present Study

Previous research clearly indicates that NSSI is relatively common among adolescents worldwide. It has also been found that NSSI is closely related to several

core features of borderline personality disorder such as mood disturbances, behavioral impulsivity, self-identity disturbances, dissociative symptoms and interpersonal disturbances. The present study investigated the prevalence and psychosocial correlates of NSSI among Chinese adolescents in Hong Kong. It is part of an ongoing longitudinal study of BPD features among Chinese adolescents in Hong Kong. Specifically, four major questions would be addressed in this study.

(1) What are the two-year prevalence rates of common NSSI behaviors among Chinese adolescents?

Based on previous studies, we selected five most representative types of NSSI behaviors (i.e., self-cutting, burning, punching, banging, and biting) and examined their two-year prevalence, frequency, and gender differences among both a large group of high school sample and a selected group of adolescents with significant BPD pathology. Since the Revised Diagnostic Interview for Borderlines (DIB-R; Zanarini et al., 1989), the instrument that we relied heavily upon in deriving several key measures in this study, uses a 2-year time frame in assessing enduring BPD features, we followed this time frame in the present study in assessing NSSI among our subjects.

(2) Are self-injurers engaging in different NSSI methods (e.g., cutting only vs. burning only vs. self-battery only) or in different frequencies (e.g., repetitive vs. occasional) different in their psychological profiles?

Different self-injurers may prefer different NSSI methods or engage in NSSI in

different frequencies. Few previous studies (e.g., Lloyd-richardson et al., 2007) have examined if these dimensions of NSSI are associated with different psychosocial profiles. To further our knowledge in this direction, we classified self-injurers into different subtypes and compared their psychological profiles. In terms of NSSI frequency, self-injurers were divided into (1) repetitive (those who engaged in NSSI three times or more in the past two years) and (2) occasional (those who have only engaged in NSSI once or twice in the past two years) groups. In terms of the severity of NSSI (Lloyd-Richardson et al., 2007), we divided subjects into (1) burners (those who engaged in burning which causes the most severe physical pain and usually irreversible skin injury), (2) cutters (those who engaged in cutting or other methods of NSSI but not burning), and (3) other self-injurers (those who engaged in other methods of NSSI but not burning or cutting).

(3) Among the affective, cognitive, behavioral and interpersonal variables, what are the most important predictors of NSSI, both cross-sectionally and longitudinally?

NSSI was consistently found to be related to mood disturbances, behavioral impulsivity, self-disturbances, and interpersonal problems (see Table 1 for references). The relative importance of these psychological features in predicting NSSI, however, has seldom been explored. Clarification of the relative importance of these psychological features in predicting NSSI will provide important information on the prevention of NSSI. Toward this end, the present study performed multivariate regression analyses to compare the relative importance of these psychological features in predicting NSSI, both cross-sectionally and longitudinally. We also performed logistic regression analyses to explore which psychological features at

baseline increases the risk for later engagement in NSSI and which decreases the risk for continuing engagement in NSSI in a multivariate context.

(4) What are the "causal" links among unstable mood, unstable sense of self, unstable relationship, and NSSI?

Previous studies have repeatedly documented the relationships between NSSI and various psychosocial features (see Table 1 for references). None of these studies, however, have explored the potential causal pathways among these psychosocial correlates and NSSI within a meaningful conceptual model. To further our knowledge in this respect, the present study tested three models exploring potential causal relationships among NSSI and other psychological correlates. These three models are depicted in Figure 1. In Model A, it is hypothesized that unstable mood and unstable sense of self may lead to unstable relationship, which may eventually result in NSSI. In Model B, we postulate that unstable mood and unstable relationship may result in unstable sense of self, which in turn, may lead to NSSI. In Model C, unstable relationship and unstable sense of self are hypothesized to cause unstable mood, which may result in NSSI. Structural equation modeling was used to compare the goodness of fit of these three models.

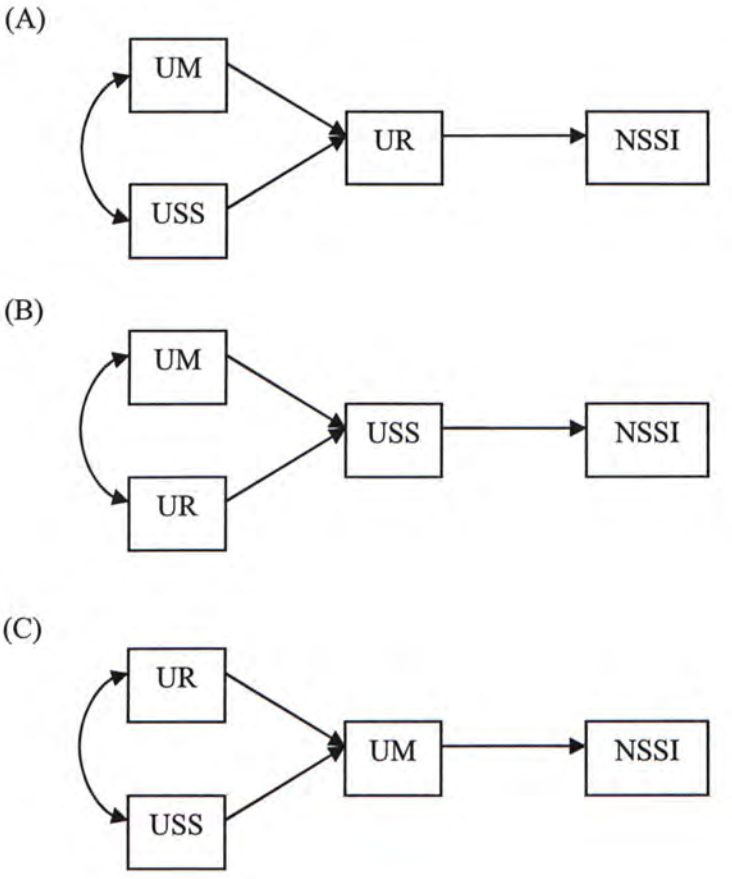

Figure 1. Three hypothesized models for the development of NSSI. Curved double-headed arrows represent covariances; straight single-headed arrows are path effects. UM = unstable mood; USS = unstable sense of self; UR = unstable relationship; NSSI = non-suicidal self-injury.

Chapter 2

METHOD

Participants

Participants of this study came from a large scale follow up study of borderline personality features among Chinese adolescents (Leung & Leung, in press). Subjects came from six high schools in Hong Kong. Four of these schools were coeducational (boys and girls), and the other two were girls-only. This resulted in more girl participants than boys. Given that BPD and NSSI are reported to be more prevalent among girls in previous studies, over-sampling of girls would be desirable to yield greater numbers of those who have significant BPD features and/or engage in NSSI.

Participants were surveyed on 2 consecutive years. At Year 1, a total of 6,212 adolescents, aged between 11 and 19 years (M = 14.56, SD = 1.81) were tested, and 68.5% (N = 4,253) of them were females. At Year 2, a total of 6,421 students, also between 11 and 19 years old (M=14.72, SD=1.94) were tested and 67.6% (N = 4,342) of them were females. Among the Year 1 sample, 4,782 participants were successfully followed at Year 2. Of them, 67.1% (N = 3,210) were females. Cross-sectional analyses were performed among the Year 2 sample, and longitudinal analyses were performed among the two-year follow-up sample. Attrition of sample was mainly due to graduation or leaving of students.

Measures

Nonsuicidal Self-Injury (NSSI)

Five types of NSSI behaviors were assessed by five separate items in Year 2. These behaviors were selected because they were the most common types of NSSI reported in previous studies. Participants were asked "In the past two years, have you

ever a) intentionally cut yourself that cause an injury; b) intentionally burn yourself that cause skin wound; c) intentionally bite yourself that cause an injury; d) intentionally punch yourself thereby cause a bruise; and e) intentionally bang your head or other parts of the body fiercely thereby cause a bruise?" These items were rated on a four-point Likert scale, ranging from 1 "never", 2 "once or twice", 3 "three to five times" to 4 "six times or more". A two-year time frame was used because that is the original framework of the Diagnostic Interview of Borderlines – Revised (DIB-R: Zanarini et al., 1989). These five items had a Cronbach's alpha of .84 in the present study.

Depressive Symptoms (DEP)

The Chinese version of the Depression Subscale of Symptoms Checklist-90 (SCL-90; Derogatis, Lipman & Covi, 1973) was used to measure depressive symptoms. The original scale consisted of 13 items. One item, "Loss of sexual interest or pleasure" was deleted in the present study as school authorities considered it inappropriate for young adolescents. Sample items include "Feeling low in energy/slowed down" and "Feelings of worthlessness". Responses were made on a 5-point Likert scale ranging from 1 "never" to 5 "always". Higher scores indicate more depressive symptoms. This scale had a Cronbach's alpha of .92 for Year 1 data and .93 for Year 2 data in this study.

MSI-BPD

The Chinese version of the McLean Screening Instrument for Borderline Personality Disorder (MSI-BPD; Zanarini et al., 2003) was used to measure BPD features (Wang, Leung, & Zhong, 2008). In the MSI-BPD, each BPD diagnostic

criterion was assessed by one item, with the exception of transient psychotic feature which was assessed by two items. Thus, MSI-BPD has 10 items in total. According to Zanarini et al., MSI-BPD had adequate one-week test-retest reliability (r = .72), good internal consistency (α = .74) and item-total correlation (ranged between .45 and .63). In this study, participants rated their level of symptom severity on a four-point scale, i.e. 1 "strongly disagree"; 2 "disagree"; 3 "agree"; 4 "strongly agree". Summation of the 10 item ratings gives a "dimensional score". These 10 items had a Cronbach's alpha of .86 for Year 1 data, and .87 for Year 2 data in this study.

One item in MSI-BPD measured NSSI. Since MSI-BPD was used in both years, we could assess change in NSSI according to this item. Participants were classified into four subgroups on the basis of their endorsement on this item. About 3.0% (n = 144) of the participants were stable self-injurers. They reported NSSI in both years. Another 4.5% (n = 212) were discontinuers, who reported NSSI in Year 1 but not in Year 2. Another 5.0% (n = 237) were deteriorators, who did not report NSSI in Year 1 but reported NSSI in Year 2. Finally, about 87.5% of all participants were stable non-self-injurers (n = 4,140). Apart from using the NSSI item in the MSI-BPD in the change analysis, we deleted this item from the MSI-BPD in all the other analyses.

Unstable Relationship (UR)

Five Items assessing unstable relationship were extracted and modified from DIB-R (Zanarini et al., 1989). Sample items include "I either love or hate other people in an extreme way" and "My relationships with other people are very unstable'. Responses were made on a 4-point Likert scale, ranging from 1 "strongly disagree" to 4 "strongly agree". Higher scores reflect more unstable relationships. It

had a Cronbach's alpha of .78 for Year 1 data, and .80 for Year 2 data.

Unstable Sense of Self (USS)

Unstable sense of self was measured by 5 items modified from the Rosenberg's Stability of Self Scale (Alaska & Olweus, 1986). Sample items include "My self-evaluations are entirely different everyday", "I am confused with my own identity", and "Sometimes I feel good one minute and then the next minute I feel terrible". Ratings were made on a 4-point scale from 1 "strongly disagree" to 4 "strongly agree". Higher scores indicate a more unstable sense of self. This scale had a Cronbach's alpha of .90 for both Year 1 and Year 2 data in this study.

Unstable Mood (UM)

Unstable mood was measured by "Reactivity to Situations" subscale of the Mood Survey (Underwood & Froming, 1980). It had adequate 7-week test-retest reliability (r = .83) and concurrent validity with emotionality (r = .69). The measure we used in this study consisted of 7 items, e.g. "Sometimes my moods swing back and forth very rapidly", "My moods always vary", and "Compared to my friends, I'm more up and down in my mood states'. Responses were made on a 4-point scale ranging from 1 "strongly disagree" to 4 "strongly agree". Higher scores indicate more labile mood. This scale had a Cronbach's alpha of .92 for Year 1 data and .93 for Year 2 data.

Behavioral Impulsivity (IMP)

Behavioral impulsivity in this study was measured using 10 items of impulsive behaviors extracted and modified from the DIB-R. Participants rated how frequent

they displayed various impulsive behaviors during the past two years on a 4-point scale from 1 "never" to 4 "six times or more". Higher scores indicate more frequent impulsive behaviors. This scale had a Cronbach's alpha of .76 for Year 1 data, and .79 for Year 2 data in this study.

These ten behaviors could be further classified into three types of impulse: hedonic impulse, aggressive impulse and impulsive substance use. Hedonic impulse was measured by 3 items, including uncontrollable binge eating, spending sprees, and promiscuity. These three items had a Cronbach's alpha of .55 for Year 1 data and .59 for Year 2 data. Aggressive impulse was measured by 5 items, including verbal outburst, physical fights, physical threats, physical assaults and property damage. These five items had a Cronbach's alpha of .71 for Year 1 data and .75 for Year 2 data. Impulsive substance use was measured by 2 items, i.e., alcohol abuse and drug abuse, and the Cronbach's alpha was .64 for Year 1 data and .68 for Year 2 data. Confirmatory factor analyses substantiated the three-factor structure (In Year 1, for girls: CFI = .93, RMSEA = .06; for boys: CFI = .95, RMSEA = .07. In Year 2, for girls: CFI = .92, RMSEA = .08; for boys: CFI = .95, RMSEA = .08).

Suicidal Thoughts/Attempts (STA)

Suicidal thoughts were measured by one item extracted from the SCL-90 depression subscale. Participants rated the item "thoughts of ending your life" on a 5-point scale, ranging from 1 "never" to 5 "always". Suicidal attempts were measured by one item adapted from DIB-R. Participants rated how frequent they attempted suicide on a 4-point scale ranging from 1 "never" to 4 "six times or more". Both items were added up to form a composite score, which was used in subsequent analyses.

Demographic Information

Gender, age and family structure were also measured. Participants' current family structure was assessed by a single item. Three choices were available on this item: (1) intact family; (2) parents separated; and (3) parents divorced. The last two choices were combined in data analyses.

Procedures

Details on translation of scales and data collection procedures of this study can be found in Leung & Leung (in press).

Simulated Diagnostic Method for BPD

In this study, we were not able to conduct diagnostic interview with our subjects as we originally planned because school authorities of the participating schools expressed serious concerns about the possible labeling effect and insisted on strict principle of anonymity. To deal with this constraint, we developed a stringent simulated diagnostic procedure to assess BPD diagnosis during Year 2 testing. It is generally agreed that BPD is characterized by four core pathological features, i.e., affective instability, impulse dyscontrol, self and cognitive disturbances, and chaotic interpersonal relationship (Leung & Zhong, 2006; Lieb et al., 2004). Thus, we selected two highly relevant items to assess each of these four features from the scales we measured unstable mood, unstable relationship, unstable sense of self and impulsive behaviors, respectively. Only those who have endorsed all of these 8 items were considered as probably BPD cases in this study.

Chapter 3

RESULTS

Means, Standard Deviations and Correlations among all Variables in Year 2

Table 3 presents the means, standard deviations and correlations among all variables in Year 2 separately for boys and girls. Boys and girls did not differ on the total frequency of NSSI. Compared to boys, girls reported significantly higher levels of depressive symptoms, BPD features (as indicated by MSI-BPD, UR, USS, UM and DIS), hedonic impulse and suicide symptoms. Boys scored higher on aggressive impulse and substance use than girls did.

NSSI was positively associated with all other variables. The magnitude of associations between NSSI and impulsivity as well as suicidal thoughts/attempts was particularly strong. We also tested gender differences in the magnitude of correlation coefficients using the Fisher's *z*' Test (Cohen & Cohen, 1983). Significant gender differences in correlations were listed in bold font. The strength of the association between NSSI and depression was significantly higher for girls (r = .34) than for boys (r = .28), $z = 2.46$, $p < .01$. The strength of the associations between NSSI and total impulsivity, on the other hand, was significantly higher for boys (r = .62) than for girls (r = .56), $z = 3.45$, $p < .001$. Among the three sub-components of impulsivity, hedonic impulse (r = .43 in boys vs. r = .48 in girls) and impulsive substance use (r = .60 in boys vs. r = .71 in girls) were more strongly related to NSSI among boys than girls. Suicidal thoughts/attempts was also related to NSSI more strongly in boys (r = .60) than in girls (r = .55), $z = 2.80$, $p < .01$.

Table 3

Correlations and Descriptive Statistics by Gender for All Variables in Year 2

Measure	1	2	3	4	5	6	7	8	9	10	11	12	*M*	*SD*
1. NSSI		**.34**	**.55**	.33	.28	.28	.26	.31	**.56**	**.43**	.47	**.60**	5.42	1.33
2. DEP	**.28**		.58	.71	.59	.65	.64	.61	.43	.39	.37	.20	**27.34**	9.37
3. STA	**.60**	.56		.45	.42	.41	.40	.48	**.50**	.41	.42	.49	**0.49**	0.72
4. MSI-BPD	.28	.70	.50		.73	.72	.73	.61	.50	**.45**	.44	.22	**17.63**	5.13
5. UR	.27	.62	.40	.76		.64	.65	.58	.43	.39	.37	.18	**9.65**	3.14
6. USS	.23	.65	.42	.73	.69		.72	.62	.38	.36	.32	.17	**9.50**	3.42
7. UM	.26	.66	.39	.75	.67	.74		.57	.44	.38	.40	.15	**14.77**	4.98
8. DIS	.28	.65	.46	.62	.60	.63	.63		.36	.34	.30	.19	**5.34**	2.27
9. IMP	**.62**	.43	**.45**	.47	.42	.39	.43	.39		.80	.90	**.55**	12.89	3.42
10.HI	**.48**	.37	.38	**.40**	.37	.35	.35	.37	.77		.49	**.38**	**4.13**	1.50
11. AI	.50	.40	.38	.45	.38	.34	.42	.35	.93	.51		**.39**	**6.67**	2.17
12. SU	**.71**	.21	.38	.23	.26	.23	.21	.24	**.67**	**.47**	**.49**		**2.11**	0.49
M	5.47	**23.92**	**0.41**	**16.33**	**8.93**	**8.88**	**13.1**	**5.04**	13.07	**3.93**	**6.99**	**2.18**		
SD	1.71	9.47	0.73	5.23	3.14	3.43	4.94	2.24	3.92	1.34	2.63	0.71		

Note. Bivariate correlations and descriptive statistics for girls are above the diagonal. Data for boys are below the diagonal. Correlations and means in bold indicate significant gender differences at .05 level. NSSI = non-suicidal self-injury; DEP = depressive symptoms; STA = suicidal thoughts and attempts; MSI-BPD = McLean Screening Instrument for Borderline Personality Disorder; UR = unstable relationship; USS = unstable sense of self; UM = unstable mood; DIS = dissociative symptoms; IMP = total impulsivity; HI = hedonic impulse; AI = aggressive impulse; SU = substance use. All correlations are significant at .001 level.

The Overall Prevalence of NSSI in the Present Study

Adolescents who reported having intentionally engaged in any type of NSSI within the past two years were classified as self-injurers. An overall 2-year prevalence rate of 15.0% (n = 953) was obtained. A chi-square analysis revealed significant gender difference in the prevalence of NSSI (16.4% in girls vs. 11.9% in boys), χ^2 (1, N = 6,371) = 22.99, $p < .001$, indicating that more girls than boys engaged in NSSI.

Compared to non-self-injurers, self-injurers were more likely to come from divorced/separate families (11.9% in self-injurers vs. 7.13% in non-self-injurers), χ^2 (1, N = 6,303) = 24.52, $p < .001$. Age was not significantly correlated with the frequency of NSSI in this sample, r (n = 6361) = -.017, *ns*.

In terms of the number of NSSI methods used, 52% (n = 496) of all self-injurers reported using only one method, and 48% (n = 457) reported using multiple methods. Among self-injurers who used only one method, 42.9% (n = 409) did it once or twice in the past two years, 6.2% (n = 59) three to five times, and 2.9% (n = 28) six times or more. Among self-injurers who used multiple methods, 12.8% (n = 122) reported harming themselves three to five times in the past two years, and another 35.2% (n = 335) six times or more.

Prevalence Specific Types of NSSI for the Whole Sample

Table 4 presents the endorsement rates of the five specific types of NSSI with breakdown by frequencies. For the total sample, cutting was the most prevalent behavior (9%), with biting came in second (8.3%), followed by punching (5.8%) and banging (5.6%). Burning was the least common type of NSSI (2.8%). When boys and girls were examined separately, the rank order of the 5 behaviors remained the

same for girls. For boys, punching (7.4%) and banging (7.3%) were the most prevalent methods, followed by biting (6.8%), cutting (6.7%) and burning (4.4%).

Gender differences in the prevalence of these five behaviors were observed. Cutting was more common among girls (10.3%) than boys (6.7%), χ^2 (1, N = 6,416) = 21.32, $p < .001$. Biting was also more common among girls (9%) than boys (6.8%), χ^2 (1, N = 6,379) = 9.06, $p < .01$. Compared to girls, boys were significantly more likely to engage in burning (2.1% vs. 4.4%), χ^2 (1, N = 6,381) = 26.12, $p < .001$, punching (5.1% vs. 7.4%), χ^2 (1, N = 6,380) = 12.19, $p < .001$, and banging (5.6% vs. 7.3%), χ^2 (1, N = 6,380) = 13.47, $p < .001$.

Table 4

Percentage of the Total Sample (N = 6,421), Boys (N = 2,079), and Girls (N = 4,342) Reporting Different Types of NSSI in the Past Two Years

	have tried			1-2			3-5			≥ 6		
	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls
Cutting	9.0	6.7	10.3*	6.0	4.7	6.6*	2.0	1.5	2.2	1.0	0.5	1.3*
Burning	2.8	4.4	2.1*	1.9	2.7	1.5*	0.7	1.3	0.5*	0.2	0.3	0.1
Biting	8.3	6.8	9.0*	6.3	4.7	7.0*	1.4	1.3	1.4	0.6	0.8	0.5
Punching	5.8	7.4	5.1*	3.9	4.6	3.5	1.3	1.5	1.1	0.6	1.1	0.4*
Banging	5.6	7.3	4.9*	3.8	4.4	3.5	1.3	1.5	1.2	0.5	1.2	0.2*

* Significant gender difference at .01 level.

BPD adolescents were significantly more likely to engage in all five types of NSSI than non-BPD adolescents. For the BPD group, biting and cutting were the most common types of NSSI, and each was endorsed by about half of all BPD adolescents. Punching and banging were prevalent in more than one third of BPD adolescents. Burning was present in about one fifth of the BPD group. It should also be noted that cutting was the most frequently used method of NSSI. It was conducted repetitively (3 times or more) among one fourth of BPD adolescents.

Subtypes of Self-injurers: Repetitive vs. Episodic Self-injurers

Table 6 presents the means and standard deviations of all psychosocial variables for repetitive and episodic self-injurers as well as non-self-injurers. Repetitive self-injurers were defined as those who engaged in one or multiple NSSI methods for three times or above in the past two years. Episodic self-injurers were defined as those who engaged in NSSI only once or twice in the past two years. To examine the effects of NSSI frequency on various psychosocial variables, a one-way multivariate analysis of variance (MANOVA) was performed. There was an overall difference in the combined dependent variable among repetitive self-injurers, episodic self-injurers and non-self-injurers (Wilk's

Prevalence of NSSI among Adolescents with Significant BPD Pathology

Table 5 presents the endorsement rates of the five specific types of NSSI with breakdown by frequencies among BPD and non-BPD adolescents. Among adolescents reporting significant BPD pathology (n = 121), 61.2% of them (n = 74) reported engaging in NSSI at least once in the past two years. This prevalence figure was almost four times higher than that of the non-BPD adolescents (14.0%), χ^2 (1, N = 6,287) = 57.32, $p < .001$. Among the self-injurers in the BPD group, 11.6% of them (n = 14) engaged in NSSI only once or twice in the past two years, another 9.1% (n = 11) 3 to 5 times, and 40.5% of them (n = 49) engaged in NSSI 6 times or more. Together, the data indicated that close to half of the adolescents with significant BPD pathology (49.6%) engaged in NSSI three times or more in the past two years.

Table 5

Percentage of BPD (N = 121) and Non-BPD (N = 6,169) Adolescents Engaging in Different Types of NSSI in the Past Two Years

	have tried		1-2		3-5		≥ 6	
	Non-BPD	BPD	Non-BPD	BPD	Non-BPD	BPD	Non-BPD	BPD
Cutting	8.2*	45.5	5.7*	20.7	1.7*	12.4	0.8*	12.4
Burning	2.5*	17.4	1.8*	9.1	0.6*	6.6	0.1	1.7
Biting	7.5*	47.1	5.9*	30.6	1.2*	9.9	0.5*	6.6
Punching	5.0*	37.2	3.6*	19.8	0.9*	11.6	0.5*	5.8
Banging	4.9*	36.5	3.5*	20.7	1.1*	9.1	0.4*	5.8

* Significant difference at .01 level.

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	Non-BPD	BPD	Non-BPD	BPD	Non-BPD	BPD	Non-BPD	BPD
Cutting	8.2*	45.5	5.7*	20.7	1.7*	12.4	0.8*	12.4
Burning	2.5*	17.4	1.8*	9.1	0.6*	6.6	0.1	1.7
Biting	7.5*	47.1	5.9*	30.6	1.2*	9.9	0.5*	6.6
Punching	5.0*	37.2	3.6*	19.8	0.9*	11.6	0.5*	5.8
Banging	4.9*	36.5	3.5*	20.7	1.1*	9.1	0.4*	5.8

* Significant difference at .01 level.

BPD adolescents were significantly more likely to engage in all five types of NSSI than non-BPD adolescents. For the BPD group, biting and cutting were the most common types of NSSI, and each was endorsed by about half of all BPD adolescents. Punching and banging were prevalent in more than one third of BPD adolescents. Burning was present in about one fifth of the BPD group. It should also be noted that cutting was the most frequently used method of NSSI. It was conducted repetitively (3 times or more) among one fourth of BPD adolescents.

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Table 6 presents the means and standard deviations of all psychosocial variables for repetitive and episodic self-injurers as well as non-self-injurers. Repetitive self-injurers were defined as those who engaged in one or multiple NSSI methods for three times or above in the past two years. Episodic self-injurers were defined as those who engaged in NSSI only once or twice in the past two years. To examine the effects of NSSI frequency on various psychosocial variables, a one-way multivariate analysis of variance (MANOVA) was performed. There was an overall difference in the combined dependent variable among repetitive self-injurers, episodic self-injurers and non-self-injurers (Wilk's $\lambda = 0.669$, F (2, 5,827) = 117.72, $p < .001$). To explore the sources of differences among the three groups, follow-up univariate tests were performed. Results and effect size for each univariate comparison were also presented in Table 6. The main effects of group status were significant for all the dependent variables. Repetitive self-injurers were more disturbed in all domains than the episodic self-injurers who in turn, scored significantly higher than non-self-injurers on all dependent variables.

Table 6

Comparisons on Study Measures in Year 2 among Repetitive and Episodic Self-injurers and Non-Self-injurers

Measures	Repetitive self-injurer (n = 545)	Episodic self-injurer (n = 418)	Non-self-injurer (n = 5,418)	Partial η^2
DEP	35.69 (10.04)$_a$	31.54 (8.74)$_b$	24.90 (8.84)$_c$	.12
STA	1.64 (1.13)$_a$	0.81 (0.70)$_b$	0.32 (0.53)$_c$	.28
MSI-BPD	22.44 (5.19)$_a$	20.12 (4.51)$_b$	16.46 (4.87)$_c$	.12
UR	12.18 (3.14)$_a$	11.01 (2.76)$_b$	9.01 (3.01)$_c$	.10
USS	12.17 (3.59)$_a$	10.56 (3.39)$_b$	8.92 (3.27)$_c$	.08
UM	18.39 (4.89)$_a$	16.74 (4.70)$_b$	13.63 (4.82)$_c$	.09
DIS	9.89 (3.11)$_a$	8.34 (3.00)$_b$	6.78 (2.68)$_c$	.10
IMP	18.70 (5.57)$_a$	14.66 (3.73)$_b$	12.24 (2.65)$_c$	.26
HI	5.92 (2.05)$_a$	4.77 (1.65)$_b$	3.82 (1.19)$_c$	.18
AI	9.84 (3.39)$_a$	7.74 (2.57)$_b$	6.39 (1.90)$_c$	.18
SU	3.03 (1.41)$_a$	2.16 (0.54)$_b$	2.04 (0.26)$_c$	.24

Note. DEP = depressive symptoms; STA = suicidal thoughts and attempts; MSI-BPD = McLean Screening Instrument for Borderline Personality Disorder; UR = unstable relationship; USS = unstable sense of self; UM = unstable mood; DIS = dissociative symptoms; IMP = total impulsivity; HI = hedonic impulse; AI = aggressive impulse; SU = substance use. Means in the same row that do not share subscripts differ at $p < .01$ using Bonferroni Post Hoc comparison.

Subtypes of Self-injurers: Burners, Cutters, and Bangers

Based on the severity of physical pain and tissue damage different NSSI behaviors caused, we also classified NSSI behaviors measured in this study into three types. Burning is classified as the most severe type because it causes the most severe physical pain and irreversible skin tissue damage. Cutting is next in its severity. Biting, punching and banging are classified as the least severe types of NSSI in this study.

Table 7 presents the means and standard deviations of all psychosocial variables for (1) burners, (2) cutters without using burning, and (3) self-injurers without using burning and cutting, as well as (4) non-self-injurers. A one-way MANOVA was performed to examine the effects of NSSI method on the combined dependent variable. A significant overall difference was observed (Wilk's $\lambda = 0.499$, F (3, 5,832) = 138.52, $p < .001$). To further explore the sources of differences, follow-up univariate tests were conducted. Results and effect size for each univariate comparison were also presented in Table 7. The main effects for NSSI methods were significant for all dependent variables. Non-self-injurers scored the lowest on all measures. For the three self-injurer groups, those who used only biting, banging and punching scored the lowest on most variables. Burners scored the highest on impulsivity and suicidal thoughts/attempts, whereas cutters without using burning scored the highest on depressive symptoms, MSI-BPD and unstable mood. These two groups of self-injurers scored similarly on other variables. These findings indicate that those who engaged in burning appear to be more impulsive, whereas those who engaged in cutting tend to experience more emotional distress.

Table 7

Comparisons on Psychosocial Variables in Year 2 among Self-injurers using NSSI of Different Severity and Non-Self-injurers

Measures	Burner (n = 179)	Cutter without burning (n = 417)	Self-injurer without burning and cutting (n = 367)	Non-self-injurer (n = 5,418)	Partial η^2
DEP	33.84 $_{ab}$ (9.41)	34.92 $_{b}$ (10.04)	32.62 $_{a}$ (9.31)	24.90 $_{c}$ (8.84)	.11
STA	2.16 $_{a}$ (1.06)	1.32 $_{b}$ (1.01)	0.81 $_{c}$ (0.77)	0.32 $_{d}$ (0.53)	..27
MSI-BPD	21.39 $_{ab}$ (4.86)	22.42 $_{b}$ (5.06)	20.33 $_{a}$ (4.84)	16.46 $_{c}$ (4.87)	.12
UR	12.02 $_{a}$ (3.09)	12.16 $_{a}$ (3.07)	10.98 $_{b}$ (2.84)	9.01 $_{c}$ (3.01)	.10
USS	12.19 $_{a}$ (3.13)	11.74 $_{a}$ (3.63)	10.83 $_{b}$ (3.66)	8.92 $_{c}$ (3.27)	.07
UM	17.35 $_{ab}$ (4.14)	18.53 $_{b}$ (4.92)	16.84 $_{a}$ (4.99)	13.63 $_{c}$ (4.82)	.08
DIS	9.74 $_{a}$ (2.61)	9.59 $_{a}$ (3.22)	8.53 $_{b}$ (3.19)	6.78 $_{c}$ (2.68)	.10
IMP	22.14 $_{a}$ (5.61)	16.74 $_{b}$ (4.79)	15.07 $_{c}$ (3.81)	12.24 $_{d}$ (2.65)	.18
HI	6.60 $_{a}$ (1.87)	5.51 $_{b}$ (1.98)	4.77 $_{c}$ (1.71)	3.82 $_{d}$ (1.19)	.18
AI	11.44 $_{a}$ (3.19)	8.53 $_{b}$ (3.18)	8.20 $_{b}$ (2.70)	6.39 $_{c}$ (1.90)	.16
SU	4.25 $_{a}$ (1.51)	2.45 $_{b}$ (0.89)	2.13 $_{c}$ (0.45)	2.04 $_{d}$ (0.26)	.23

Note. DEP = depressive symptoms; STA = suicidal thoughts and attempts; MSI-BPD = McLean Screening Instrument for Borderline Personality Disorder; UR = unstable relationship; USS = unstable sense of self; UM = unstable mood; DIS = dissociative symptoms; IMP = total impulsivity; HI = hedonic impulse; AI = aggressive impulse; SU = substance use. Means in the same row that do not share subscripts differ at $p < .01$ using Bonferroni Post Hoc comparison.

Predicting NSSI Using BPD Features

a. Cross-sectional Analyses

To examine the relative importance of different BPD features in predicting NSSI, we performed standard regression analyses separately for boys and girls using the total frequency of NSSI as the dependent variable, and DEP, MSI-BPD, UR, USS, UM, DIS, HI, AI, and SU as independent variables. Table 8a presents the unstandardized regression coefficients (B), the standardized regression coefficients (β), the squared semipartial correlations (sr^2), R, R^2, and adjusted R^2 for each regression equation.

For boys, the regression equation was significant, F (9, 1,913) = 265.95, p < .001. Altogether, 56% (55% adjusted) of the variability in the frequency of NSSI was predicted by all predictors. Dissociative symptoms and the three types of impulsive behaviors were significant. Among these predictors, only aggressive impulse and substance use made unique contribution in predicting NSSI. Substance use explained 25% (refer to its corresponding sr^2) of the unique variability in NSSI, and aggressive impulse accounted for only 1% of the unique variance. In addition, all predictors in combination contributed another 30% of shared variance in predicting NSSI (total R^2: .56 – the sum of sr^2: .26 = .30).

For girls, the regression equation was also significant, F (9, 4,077) = 344.34, p < .001. Altogether, 43% of the variability in NSSI was predicted by all predictors. Depressed mood, dissociative symptoms, and the three types of impulsive behaviors were significant. Among the three impulsive behaviors, hedonic impulse contributed 1%, aggressive impulse 3%, and substance use 15% of the unique variability in predicting NSSI. All the predictors in combination contributed another 24% of shared variance in predicting NSSI (total R^2: .43 – the sum of sr^2: .19 = .24).

Table 8a

Standard Regression Analyses Using Different BPD Features to Predict NSSI among Boys and Girls

	Boys (n = 2,079)			Girls (n = 4,342)		
Predictors	B	β	sr^2	B	β	sr^2
DEP	.01	.06	.00	.01**	.08	.00
MSI-BPD	-.00	-.00	.00	.00	.01	.00
UR	-.01	-.02	.00	.00	.00	.00
USS	-.03	-.06	.00	.01	.03	.00
UM	.01	.03	.00	-.01	-.06	.00
DIS	.04*	.06	.00	.04**	.09	.00
HI	.09**	.07	.00	.09**	.10	.01
AI	.08**	.13	**.01**	.12**	.20	**.03**
SU	1.53**	.61	**.25**	1.22**	.44	**.15**
			R = .75**			**R = .66****
			R^2 = .56			**R^2 = .43**
			Adjusted R^2 = .55			**Adjusted R^2 = .43**
			Shared variance = .30			Shared variance = .24

Note. DEP = depressive symptoms; MSI-BPD = McLean Screening Instrument for Borderline Personality Disorder; UR = unstable relationship; USS = unstable sense of self; UM = unstable mood; DIS = dissociative symptoms; HI = hedonic impulse; AI = aggressive impulse; SU = substance use. sr^2 = squared semi-partial correlation representing the proportion of variance explained uniquely by each predictor. Shared variance = Total R^2 – the sum of sr^2. Significant gender differences were indicated in bold. * significant at .01 level; ** significant at .001 level

We also compared the difference in explanatory power of these BPD features between boys and girls using a statistical method proposed by Olkin and Finn (1995)[1]. Results showed that the amount of variance in NSSI explained by the five predictors were significantly larger for boys (.56) than for girls (.43), $Z = 2.89$, $p < .01$.

Further, to determine whether the same individual predictors made different unique contributions to NSSI across genders, we performed regression analysis of the full interaction model with the pooled sample[2]. Aggressive impulse and substance use made significantly different contribution to NSSI across genders. Aggressive impulse contributed 2% more unique variance among girls (3%) than among boys (1%), whereas substance use made 10% more unique contribution to NSSI among boys (25%) than among girls (15%).

The above regression analyses reveal that the three impulsive behaviors appear to be the most important predictors of NSSI for both genders. To further explore the relative importance of these three impulsive behaviors in predicting NSSI, we performed another regression analysis using only these three impulsive behaviors as predictors. Results were shown in Table 8b. For boys, the regression equation was significant, F (3, 2,028) = 826.70, $p < .001$. The three predictors captured almost the

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[1] Olkin and Finn (1995) proposed a method to test the hypothesis H_0: $\rho_1^2 = \rho_2^2$. Here, ρ_1^2 and ρ_2^2 are the population squared multiple correlation coefficients for boys and girls, respectively. This method employs a transformation F_z for R_1^2 and R_2^2 based on the Fisher's Z variance-stabilizing transformation for zero-order correlation coefficients, that is, $F_z(R^2) = \log(\frac{1+\sqrt{R^2}}{1-\sqrt{R^2}})$. For large samples, Olkin and Finn showed that the statistic $Z = \frac{F_z(R_1^2) - F_z(R_2^2)}{\sqrt{\frac{4}{N_1} + \frac{4}{N_2}}}$ is asymptotically distributed as a standard normal variate under H_0.

[2] We created a dummy variable: gender, such than gender = 0 for girls, and gender = 1 for boys. Next, 5 product terms between gender and each of the 5 predictors were generated. We than combined the samples and fitted the following full model: $y = c_0 + c_1x_1 + c_2x_2 + \ldots c_5x_5 + c_6\text{gender} + c_7\text{genderx}_1 + c_8\text{genderx}_2 + \ldots c_{12}\text{genderx}_5 + e$. If the regression coefficients of the product terms were significantly different from zero, the regression coefficients of those predictors would be significantly different from boys to girls in the separate regression models.

same amount of variance (55%) in NSSI as when all BPD features were used as predictors (56%). SU and AI accounted for 24% and 1% of unique variance, respectively. The three impulsive behaviors in combination contributed another 29% of shared variance.

Table 8b

Standard Regression Analyses Using the Three Types of Impulsive Behaviors to Predict NSSI among Boys and Girls

	Boys (*n* = 2,079)			Girls (*n* = 4,342)		
Predictors	*B*	*β*	sr^2	*B*	*β*	sr^2
HI	.15**	.12	.01	.12**	.14	.01
AI	.10**	.15	**.01**	.13**	.22	**.03**
SU	1.44**	.59	**.24**	1.23**	.45	**.16**
			R = .74**			**R = .66****
			R^2 = .55			**R^2 = .43**
			Adjusted R^2 = .55			**Adjusted R^2 = .43**
			Shared variance = .29			Shared variance = .23

Note. HI = hedonic impulse; AI = aggressive impulse; SU = substance use. sr^2 = squared semi-partial correlation representing the proportion of variance explained uniquely by each predictor. Shared variance = Total R^2 – the sum of sr^2. Significant gender differences were indicated in bold. ** significant at .001 level

For girls, the regression equation was also significant, F (3, 4,262) = 826.70, p < .001. The three impulsive behaviors captured the same amount of variance (43%) in NSSI as when all BPD features were used as predictors. Among these three types of impulsive behaviors, HI contributed 1%, AI 3% and SU contributed 16% of the unique variability in predicting NSSI. The three predictors in combination contributed another 23% of shared variance. Findings of these analyses clearly indicate that among all core BPD features, behavioral impulsivity is the most important variable in predicting NSSI. Moreover, among the three types of impulsive behaviors, SU is the most powerful predictor for NSSI.

Since NSSI is a highly defining behavioral feature among individuals with BPD, we also performed the same regression analyses among a selected group of adolescents with significant BPD pathology to examine if the same findings hold. Results were presented in Table 9a. The regression equation was significant, F (9, 105) = 13.55, p < .001. All the predictors explained 54% (50% adjusted) of the total variance in NSSI. Only aggressive impulse and substance use were significant predictors. They accounted for 2% and 18% of unique variance, respectively. All the predictors in combination contributed another 34% (total R^2: .54 – the sum of sr^2: .20 = .34) of shared variability in NSSI.

Table 9a

Standard Regression Analyses Using the Three Types of Impulsive Behaviors to Predict NSSI among Adolescents with Significant BPD Pathology (n = 121)

Predictors	*B*	*β*	sr^2
DEP	.01	.03	.00
MSI-BPD	.01	.01	.00
UR	.07	.07	.00
USS	-.14	-.15	.00
UM	.02	.01	.00
DIS	.09	.08	.00
HI	.11	.07	.00
AI	.22*	.22	.02
SU	1.43**	.56	.18
			$R = .73^{**}$
			$R^2 = .54$
			Adjusted $R^2 = .50$
			Shared variance = .34

Note. DEP = depressive symptoms; MSI-BPD = McLean Screening Instrument for Borderline Personality Disorder; UR = unstable relationship; USS = unstable sense of self; UM = unstable mood; DIS = dissociative symptoms; HI = hedonic impulse; AI = aggressive impulse; SU = substance use. sr^2 = squared semi-partial correlation representing the proportion of variance explained uniquely by each predictor. Shared variance = Total R^2 – the sum of sr^2. * significant at .05 level; ** significant at .001 level

Similarly, we performed another regression analysis including only the three types of impulsive behaviors to predict NSSI among BPD adolescents. Results were shown in Table 9b. This regression equation was also significant, F (3, 114) = 41.16, $p < .001$. Altogether, the three predictors explained 52% (51% adjusted) of the total variance in NSSI. HI, AI and SU each contributed 1%, 5% and 17% of unique variance, respectively. The three in combination contributed another 29% of shared variance. This result pattern among adolescents with significant BPD pathology is similar to that in the general population, indicating that impulsive behaviors, in particular substance use, are the most powerful predictors of NSSI among adolescents.

Table 9b

Standard Regression Analyses Using the Three Types of Impulsive Symptoms to Predict NSSI among Adolescents with Significant BPD Pathology

Predictors	B	β	sr^2
HI	.19	.12	.01
AI	.25*	.25	.05
SU	1.32**	.51	.17
			$R = .73^{**}$
			$R^2 = .52$
			Adjusted $R^2 = .51$
			Shared variance = .29

Note. HI = hedonic impulse; AI = aggressive impulse; SU = substance use. sr^2 = squared semi-partial correlation representing the proportion of variance explained uniquely by each predictor. Shared variance = Total R^2 – the sum of sr^2. * significant at .01 level; ** significant at .001 level

b. Longitudinal Analyses

Predicting Year 2 NSSI by Year 1 BPD Features

We also conducted the same set of regression analyses using Year 1 BPD features to predict Year 2 NSSI. Results were presented in Table 10a. The regression equation for boys was significant, F (8, 1,456) = 15.043, $p < .001$. Altogether, Year 1 BPD variables explained 8% (7% adjusted) of the total variance of Year 2 NSSI among boys. UR, UM, AI and SU were significant predictors. UR and SU uniquely contributed 1% and 2% of NSSI variability, respectively. All the Year 1 predictors in combination contributed another 5% in shared variability.

The regression equation among girls was also significant, F (8, 3,039) = 32.23, $p < .001$. All the Year 1 predictors together accounted for 9% of the total variability of Year 2 NSSI. DEP and the three components of impulsivity were significant predictors. However, only HI and SU each accounted for 1% unique variance in NSSI. All the predictors in combination contributed another 7% in shared variability. In terms of the magnitude of unique contribution (sr^2) and standard regression coefficient (β), impulsive behavior in the preceding year was still the most useful predictor for Year 2 NSSI for both genders.

Table 10a

Standard Regression Analyses Using Year 1 BPD Features to *Predict Year 2 NSSI among Boys and Girls*

	Boys (n = 1,477)			Girls (n = 3,071)		
Predictors	B	β	sr^2	B	β	sr^2
DEP	.01	.07	.00	.01**	.07	.00
MSI-BPD	.01	.04	.00	.02	.07	.00
UR	-.07**	-.13	.01	-.00	-.00	.00
USS	-.03	-.07	.00	.01	.04	.00
UM	.04**	.13	.00	.00	.01	.00
HI	.02	.02	.00	.11**	.02	.01
AI	.05*	.07	.00	.04**	.06	.00
SU	.47**	.18	.02	.27**	.08	.01
			R = .28**			R = .30**
			R^2 = .08			R^2 = .09
			Adjusted R^2 = .07			Adjusted R^2 = .09
			Shared variance = .05			Shared variance = .07

Note. DEP = depressive symptoms; MSI-BPD = McLean Screening Instrument for Borderline Personality Disorder; UR = unstable relationship; USS = unstable sense of self; UM = unstable mood; HI = hedonic impulse; AI = aggressive impulse; SU = substance use. sr^2 = squared semi-partial correlation representing the proportion of variance explained uniquely by each predictor. Shared variance = Total R^2 – the sum of sr^2. * significant at .05 level; ** significant at .001 level

Next, we used only the three types of impulsive behaviors in Year 1 as predictors of Year 2 NSSI. Results were presented in Table 10b. For boys, the regression equation was significant, F (3, 1523) = 32.56, $p < .001$. Altogether, the three impulsive behaviors in Year 1 explained 6% of the total variance in Year 2 NSSI. SU accounted for 2% of the unique variance and the three predictors in combination contributed another 4% of shared variance in Year 2 NSSI.

The regression equation for girls was also significant, F (3, 3134) = 90.96, $p < .001$. The three Year 1 predictors together accounted for 8% of the total variability in Year 2 NSSI. Among the three predictors, HI contributed 2%, AI 1% and SU contributed 1% of unique variance in NSSI. In addition, the three impulsive behaviors in combination contributed another 4% of shared variance. Thus, even if we excluded other BPD features and retained only impulsive behaviors, the amount of total variance explained in NSSI did not decrease very significantly. Similar to results from cross-sectional analyses, these findings indicate that impulsive behaviors were the most important predictors among other BPD features for future NSSI behavior.

Table 10b

Standard Regression Analyses Using the Three Year 1 Impulsive Behaviors to Predict Year 2 NSSI among Boys and Girls

	Boys (n = 1,477)			Girls (n = 3,071)		
Predictors	B	β	sr^2	B	β	sr^2
HI	.06	.04	.00	.15**	.15	.02
AI	.06*	.08	.00	.07**	.11	.01
SU	.42**	.17	.02	.37**	.11	.01
			R = .25**			R = .28**
			R^2 = .06			R^2 = .08
			Adjusted R^2 = .06			Adjusted R^2 = .08
			Shared variance = .04			Shared variance = .04

Note. HI = hedonic impulse; AI = aggressive impulse; SU = substance use. sr^2 = squared semi-partial correlation representing the proportion of variance explained uniquely by each predictor. Shared variance = Total R^2 – the sum of sr^2.
* significant at .01 level; ** significant at .001 level

Predicting Self-injurers Status Change

To examine which variables in Year 1 could predict changes in NSSI status over time, multivariate logistic regression analyses were performed, with the Year 1 DEP, MSI-BPD (without the NSSI item), UR, USS, UM, HI, AI and SU as the predictors. Three pairwise comparisons were considered: (a) Stable non-self-injurers (no NSSI during both T1 and T2) versus Deteriorators (no NSSI during T1 but yes during T2); (b) Stable self-injurers (NSSI during both T1 and T2) versus discontinuers (NSSI during T1 but no NSSI during T2); and (c) Stable non-self-injurers versus stable self-injurers. Table 11 presents regression coefficients, Wald statistics, odds ratios (OR), and 95% confidence intervals for odds ratios (95% CI) for each predictor.

Stable non-self-injurers versus Deteriorators. This logistic regression examined which variables at T1 put adolescents at higher risk to engage in NSSI at a later time. A test of the full model with all predictors against a constant-only model was statistically significant, χ^2 (8, N = 4,782) = 354.22, $p < .001$, indicating that the predictors, as a set, reliably distinguished between Stable non-self-injurers and Deteriorators. As for individual predictors, T1 DEP (OR = 1.05, 95% CI = 1.02-1.07), MSI-BPD (OR = 1.15, 95% CI = 1.09-1.22), and SU (OR = 1.85, 95% CI = 1.48 - 2.30) were predicative of later engagement in NSSI. As indicated by the magnitude of odd ratios, substance use was the strongest predictor. Those who increased their substance use by 1 unit were about 2 times more likely to engage in NSSI than those who remained at the same level of substance use.

Stable self-injurers versus Discontinuers. This logistic regression analysis examined which variables at T1 would help adolescents discontinue NSSI acts. The full model with all predictors was significant, χ^2 (8, N = 4,782) = 104.15, $p < .001$. MSI-BPD (OR = 0.86, 95% CI = 0.79-0.94) and SU (OR = 0.51, 95% CI = 0.34-0.77)

were significant. SU was also the most powerful predictor. Those who decreased their substance use by 1 unit were about half as likely to engage in NSSI as those who remained at the same level of substance use.

Stable non-self-injurers versus Stable self-injurers. This logistic regression analysis examined which variables at T1 would help adolescents stay clean from NSSI all long the way. The full model with all predictors was significant, χ^2 (8, N = 4,106) = 371.54, $p < .001$. DEP (OR = 1.04, 95% CI =1.01 - 1.07), MSI-BPD (OR = 1.16, 95% CI =1.08 - 1.24), ML (OR = 1.06, 95% CI =1.00 - 1.12), and SU (OR = 1.88, 95% CI =1.45 – 2.42) were significant predictors. SU again was the most powerful predictor. Increase the level of substance use by 1 unit may almost double the risk of becoming a stable self-injurer.

Table 11

Summary of Multivariate Logistic Regression Predicting NSSI Change by Study Measures in Year 1

	Stable non-self-injurers (n = 4,140) vs. Deteriorators (n = 212)			Stable self-injurers (n = 144) vs. Discontinuers (n = 237)			Stable non-self-injurers (n = 4,140) vs. Stable self-injurers (n = 144)		
Predictors	*B*	Wald	OR (95% CI)	*B*	Wald	OR (95% CI)	*B*	Wald	OR (95% CI)
DEP	.04	15.37**	1.05 (1.02, 1.07)	-.02	2.09	0.98 (0.94, 1.01)	.04	7.85	1.04 (1.01, 1.07)
MSI-BPD	.14	24.38**	1.15 (1.09, 1.22)	-.15	11.04*	0.86 (0.79, 0.94)	.15	18.25	1.16 (1.08, 1.24)
UR	.04	0.95	1.04 (0.96, 1.12)	.02	0.09	1.02 (0.90, 1.15)	.06	1.39	1.06 (0.96, 1.16)
USS	-.04	1.31	0.96 (0.90, 1.03)	-.01	0.01	0.99 (0.89, 1.11)	-.01	0.10	0.99 (0.91, 1.07)
UL	.02	0.81	1.02 (0.98, 1.07)	-.03	0.80	0.97 (0.90, 1.04)	.06	4.08	1.06 (1.00, 1.12)
HI	.06	1.05	1.06 (0.95, 1.18)	-.06	0.60	0.94 (0.80, 1.10)	.10	2.42	1.10 (0.98, 1.24)
AI	.05	1.67	1.05 (0.98, 1.12)	.03	0.36	1.03 (0.94, 1.13)	.07	3.21	1.07 (0.99, 1.16)
SU	.61	29.54**	1.85 (1.48, 2.30)	-.68	10.29*	0.51 (0.34, 0.77)	.63	22.98	1.88 (1.45, 2.43)

Note. DEP = depressive symptoms; MSI-BPD = McLean Screening Instrument for Borderline Personality Disorder; UR = unstable relationship; USS = unstable sense of self; UM = unstable mood; HI = hedonic impulse; AI = aggressive impulse; SU = substance use.
* significant at .01 level; ** significant at .001 level

Testing the Development of NSSI

Three competing models of the development of NSSI as hypothesized (see Figure 1) were tested using EQS 6.1. Since the data violated the assumption of multivariate normality, analyses were rescaled by Satorra Bentler modification (Satorra, Chou, & Bentler, 1991). Each of the three path models was first estimated separately for boys and girls, and multiple-group analyses were performed to test the moderation effect of gender. Since there were no gender differences in all three models, data from boys and girls were combined to produce the final estimates. Table 12 presents the Satorra Bentler Chi-square statisitics (χ^2), degree of freedom (*df*), Akaike information criterion (AIC), normed fit index (NFI), comparative fit index (CFI), and root mean-square error of approximation (RMSEA) respectively for each model. Since the three models were not nested, we compared the magnitude of AIC to determine the best fitted model. The smaller the AIC index, the better the model fitted the data.

Table 12

Model Fit Indices for the Three Competing Models of the Development of NSSI

Model	χ^2	*df*	AIC	NFI	CFI	RMSEA (95%CI)
A	61.33	2	57.33	.989	.989	.069 (.055, .084)
B	80.10	2	76.10	.985	.986	.079 (.065, .094)
C	90.99	2	86.99	.983	.984	.085 (.070, .100)

Note. Model A, B and C refer to Figure 1.

All three models had reasonable fit to the data (their CFI were all above .90, and RMSEA were all below .10). Model A had the smallest AIC index, suggesting that it was the best fitted model among the three. The standardized structural coefficients of Model A were shown in Figure 2. This finding suggests that unstable mood (unstandardized coefficient B = .246, $p < .01$) and unstable sense of self (B = .344, $p < .01$) among adolescents may result in unstable relationship, and unstable relationship (B = .123, $p < .01$), in turn, may trigger NSSI. In this model, antecedent variables accounted for 50.9% of the variance in unstable relationship, and 7.2% of the variance in NSSI.

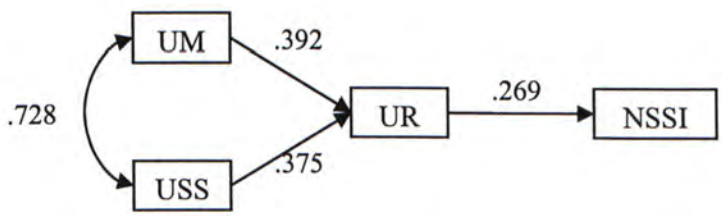

Figure 2. The best fitted model of the development of NSSI. All values are standardized coefficients; all coefficients are significant. UM = unstable mood; USS = unstable sense of self; UR = unstable relationship; NSSI = non-suicidal self-injury.

The Moderating Effect of Impulsivity on the Development of NSSI

Since findings from the multiple regression analyses showed that impulsivity was strongly related to NSSI, we also tested whether impulsivity exerted a moderating effect on the development of NSSI in our causal model. The total impulsivity score was median-split to form a high impulsivity and low impulsivity subgroups. Multiple-group analyses were then performed to determine which paths in the model were altered by the moderator.

In multiple-group analysis, the path model was estimated simultaneously in both subgroups with all parameters freely estimated, and constraints were then imposed to determine whether the fit of the constrained model differed significantly from that of the base model, using the chi-square difference score with degrees of freedom equal to the number of parameters constrained. The unconstrained base model had a reasonable fit: χ^2 (4) = 38.93, $p < .01$, CFI = .993, RMSEA = .053, with 95% confidence interval from .039 to .069. This base model is presented in Figure 3, showing unstandardized structural path coefficients for high impulsivity and low impulsivity subgroups, respectively, because only unstandardized coefficients can be compared across groups. Follow-up analyses were conducted with each of the four structural paths being individually constrained to be equal across subgroups. The path from unstable relationship to NSSI was significantly different across subgroups, $\Delta\chi^2$ (1) = 175.67, $p < .001$. The strength of this path was significantly higher for the high impulsivity subgroup than for the low impulsivity subgroup (the corresponding standardized coefficients were .253 vs. .139). The covariance between unstable mood and unstable sense of self was also significantly different, $\Delta\chi^2$ (1) = 28.62, $p < .001$. The strength of this path was significantly higher for the low impulsivity subgroup than for the high impulsivity subgroup (the corresponding standardized coefficients

were .733 vs. .670). The other two structural paths (from unstable mood and unstable sense of self to unstable relationship) did not differ substantially across subgroups. Overall, the whole model accounted for 6.4% of the total variability in NSSI for the high impulsivity subgroup, and only 1.9% for the low impulsivity subgroup. Thus, the moderating effect of impulsivity on the development model of NSSI was established.

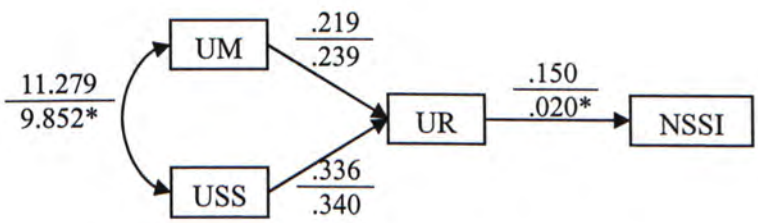

Figure 3. The moderating effect of impulsivity on the development of NSSI. All values are unstandardized coefficients. Values above and below line are for high versus low impulsivity subgroups. UM = unstable mood; USS = unstable sense of self; UR = unstable relationship; NSSI = non-suicidal self-injury. * Structural coefficients above and below line differ significantly at .01 level.

Chapter 5

DISCUSSION

The present study examined the prevalence and psychological correlates of NSSI among Chinese community adolescents in Hong Kong. We also investigated the relationships between NSSI and several core BPD features such as mood disturbances, behavioral impulsivity, unstable interpersonal relationships, unstable sense of self, and dissociative symptoms, both cross-sectionally and longitudinally.

Findings indicated that boys and girls reported comparable mean frequency level of NSSI. With regard to other variables, girls reported more depressive symptoms, BPD features, and suicidal thoughts/attempts than boys. This finding is in concert with abundant literature indicating that females are more likely to report various psychological symptoms (Crick & Zahn-Waxler, 2003). In contrast, boys reported higher levels of aggressive impulse and substance use than girls, which are also consistent with previous findings which show that boys tend to display more acting- out behaviors than girls (Nock et al., 2006; Ross & Heath, 2003).

NSSI was positively related to all other variables in this study. The magnitude of these zero-order correlations ranged from .26 - .60 for girls and .23 - .71 for boys. These findings support that NSSI is associated with various psychological problems such as mood disturbances, behavioral impulsivity, unstable interpersonal relationships, unstable sense of self, dissociative symptoms, and suicidal thoughts/attempts (refer to Table 1), which are also core characteristics of BPD. Particularly, our findings revealed a strong correlation between NSSI and behavioral impulsivity (.56 for girls and .62 for boys), especially with substance use (.60 for girls and .71 for boys). These findings support others' observation that NSSI may share something in common with other impulsive behaviors (Lacey & Evans, 1986;

Favazza, 1998).

Findings of this study also reveal gender differences in the magnitude of correlations between NSSI and some psychological variables. Relative to boys, NSSI among girls is more strongly related to depression. Emotional distress seems to play a relatively more important role in the development of NSSI among girls than among boys. Relative to girls, boys' NSSI and suicidality are more strongly related to impulsivity. Behavioral impulsivity seems to play a relatively more important role in the development of NSSI and suicidal behaviors among boys than among girls. This pattern of findings seems to contradict what have been reported by Patton et al. (1997). In their study, the associations between deliberate self-harm behaviors and frequent antisocial behavior and substance use were evident only in girls. These authors admitted that their findings appeared to contradict the suggestion that self-harm and suicidal behavior are more likely to be associated with antisocial behavior in boys and depressive symptoms in girls, they did not provide any possible explanations to their findings. We speculate that since antisocial behaviors and marijuana use are more common among western male adolescents than their Chinese counterparts (Greenberger, Chen, Beam, Whang, & Dong, 2000), no matter whether they engage in deliberate self-harm or not, these behaviors may not successfully differentiate self-harmers and non-self-harmers in western boys. For western girls, however, both frequent antisocial behaviors and marijuana use are not common behaviors. They may indicate extreme emotional disturbances or impulse dyscontrol predispositions as deliberate self-harm. Thus, these problem behaviors exhibited significant associations with deliberate self-harm in western girls.

Phenomenology of NSSI

Results of the present study indicate that overall, 15.0% of Chinese adolescents in Hong Kong engaged in one or more kinds of NSSI (including self-cutting: 9%; burning: 2.8%; biting: 8.3%; punching: 5.8%; and banging; 5.6%) at least once within the past two years. These figures indicate that NSSI are relatively common among Chinese adolescents in Hong Kong. In our sample, significantly more girls (16.4%) than boys (11.9%) reported engaging in NSSI. Moreover, adolescents coming from divorced families (11.9%) seem to be at a higher risk for NSSI than those coming from intact families (7.13%).

The prevalence figure of NSSI obtained in this study is much higher than that in another adolescent study in Hong Kong (3.8%, Wong et al., 2007). Two possible explanations may account for this discrepancy. First, while Wong et al. assessed the 12-month prevalence rate of NSSI in their study, the present study assessed NSSI in the past two years. It is natural that the 2-year prevalence is higher than the 1-year prevalence. Another possible explanation may have to do with the different specific NSSI behaviors included in the two studies. In Wong et al.'s study, their definition of NSSI included cutting, burning, reckless behavior (e.g., jumping, bone breaking) and overdose. In the present study, we focused on assessing the most common physical self-injurious behaviors which include cutting, burning, biting, punching and banging. Our findings indicated that besides cutting, biting, punching and banging, self-injurious behaviors that were not included in Wong et al.'s study, are actually relatively common self-injurious behaviors among Chinese adolescents in Hong Kong.

Compared to another NSSI study among Chinese adolescents in mainland China (Sun et al., 2008), the prevalence figure in the present study is lower (15.0% vs.

22.3%). This discrepancy, again, may be related to different NSSI behaviors included in both studies. The most prevalent type of NSSI in Sun et al.'s study was pinching (17%), which was not included in the present study. With regard to specific types of NSSI, however, the prevalence figures are comparable even though different time frames of assessment were used in the two studies. For example, the prevalence of cutting is 9.0% in our study vs. 9.3% in theirs, and the prevalence of banging is 5.6% and 7.1% in the two studies, respectively.

Among the self-injurers in the present study, less than half (42.9%) conducted NSSI only once or twice within the past two years, 19% three to five times, and the remaining 38.1% harmed themselves six times or more. In other words, over half (57.1%) of the self-injurers in this study belong to the repetitive type.

Moreover, some previous studies reported that the majority of self-injurers used only one method to self-harm (e.g., Laye-Gindhu & Schonert-Reichl, 2007; Muehlenkamp & Gutierrez, 2004; Ross & Heath, 2002), our study, however, found that almost half of self-injurers (48%) engaged in multiple NSSI methods.

One possible explanation for this discrepancy may be related to the different methods used in assessing NSSI. All three previous studies used a screening question and then asked participants to provide detailed information on what methods of NSSI they used. This method relies heavily on the active recalling ability of the subjects. Thus, the one that caused the most severe consequences or the most frequently used NSSI method may over cloud the memories of other NSSI methods. The present study used the cued listing method and provided a specific checklist of five different NSSI behaviors. This method requires only passive recognition rather than active memory of the participants and therefore may result in higher endorsement rates of NSSI methods. Some other previous studies using the cued listing method also

reported higher prevalence rates as well as more methods endorsed (e.g., in Lloyd-Richardson et al.' study (2007), 58% of self-injurers reported engaging in multiple NSSI methods).

Gender Differences in NSSI Practice

The present study found that while the mean frequency of NSSI is similar across gender (5.42 for girls and 5.47 for boys), the overall two-year prevalence rate of NSSI was higher among girls (16.4%) than among boys (11.9%). The finding that even though fewer boys reported engaging in NSSI, as a group boys reported similar mean frequency of NSSI as girls did suggest that male self-injurers are more likely to be repetitive ones. This finding is consistent with previous clinical studies which show that grand self-harmers (i.e., people with five or more self-harm episodes) are more likely to be male (Appleby & Warner, 1993).

The orders of the prevalence rates of the five NSSI behaviors are different across genders. For girls, cutting (10.3%) and biting (9.0%) are the most prevalent types, followed by punching (5.1%) and banging (4.9%). For boys, punching (7.4%) and banging (7.3%) are the most prevalent methods, followed by biting (6.8%) and cutting (6.7%). Burning is the least common method for both genders (2.1% for girls and 4.4% for boys). Girls were significantly more likely than boys to engage in cutting and biting; while boys were more likely than girls to engage in punching, banging and burning. These gender differences are consistent with previous findings (Garrison et al., 1993; Laye-Gindhu & Schonent-Reichl, 2005; Patton et al., 1997). This pattern of findings may reflect gender differences in behavioral expression of emotional distress. In distress, girls may be more prone to turn their negative emotion and frustration inward and hurting themselves by cutting or biting themselves, both

acts can be considered as acting-in types of behavior. Boys, on the other hand, may be more prone to displace their distress or frustration outward by hitting or punching objects around, both acts can be considered as acting-out types of behavior. These gender differences in behavioral expression of emotional distress echo previous findings on gender differences in adolescent symptomatology, which showed that adolescent girls were more prone to report inwardly directed psychiatric symptoms, while boys were more prone to report behaviorally acting-out (Ostrov, Offer, & Howard, 1989).

Finding of this study also indicates that boys are much more likely than girls (double the number) to engage in burning. The same trend of gender difference was also observed in a previous study (Yates & Tracy, 2008), although it did not reach the significance level in that study. This gender difference in the prevalence of burning may be accounted for by two possible explanations. One is that since boys are more likely to smoke than girls, burning using a lighter or a lighted cigarette seems to be a more convenient, thus a more likely method to self-injure among boys. The other possible explanation is related to the clinical severity of burning. Since burning may cause the most severe skin injury, only individuals with a high impulsive tendency may adopt this method. Boys, as revealed from our prior analyses, are more impulsive than girls. Therefore, boys may be more likely to engage in burning than girls.

In comparison to some Western studies which used a bigger checklist to assess NSSI (e.g., Lloyd-Richardson et al., 2007; Lundh et al., 2007; Yates & Tracy, 2008), the prevalence of specific types of NSSI are all lower in the present study even though we used a 2-year time frame while they assessed the 1-year prevalence (refer to Table 1 for the detailed prevalence figures of these studies). This may reflect some

cultural differences in the way of relieving emotional distress. It has long been documented that Chinese adolescents had lower rates of violent behaviors, as well as alcohol and drug use (Stoff, Breiling, & Maser, 1997). This cultural difference may be partly related to the emphasis of traditional Chinese values on impulse control, which may serve as a protective factor buffering against the engagement in aggressive behaviors, substance use and NSSI.

NSSI Among Adolescents With Significant BPD Pathology

The present study found that among adolescents with significant BPD pathology, about two thirds of them engaged in NSSI at least once in the past two years. Moreover, about half of them reported multiple NSSI episodes. These findings concur with those reported in previous clinical literatures. In one of these studies, Duilt, Fyer, Leon, Brodsky, and Frances (1994) found that 19% of the BPD patients were infrequent mutilators, and another 31% were frequent mutilators, adding up to 50% of the BPD patients who had ever engaged in NSSI. In another study, Zlotnick, Mattia, and Zimmerman (1999) reported that 61.8% of BPD patients had engaged in NSSI. Zanarini et al. (2006) reported an even higher prevalence figure, up to 90.5% of BPD patients in their study engaged in NSSI. Thus, results in the present study support that NSSI is much more prevalent among individuals with BPD pathology than the general population.

Among the five specific NSSI, our findings indicate that biting (47.1%) and cutting (45.5%) are the two most prevalent types of NSSI among Chinese adolescents with significant BPD pathology, and punching (37.2%) and banging (36.5%) are next in order. Burning (17.4%), again, is the least prevalent method.

Subtypes of Self-injurers: Repetitive vs. Episodic Self-injurers

Previous studies mostly just compared adolescents who engaged in NSSI with those who do not on different psychological variables. The present study further divided self-injurers into repetitive (those who engaged in NSSI for three times or more in the past two years) and episodic subgroups (those who engaged in NSSI for once or twice in the past two years) and compared them with controls who reported no NSSI. Results indicate that repetitive self-injurers were the most disturbed in all domains. Episodic self-injurers, while functioned better than repetitive self-injurers, scored higher on all measures than the control group. These findings are consistent with results from previous studies which indicated that adolescents who engaged in NSSI, as a group, experienced higher levels of emotional, cognitive and behavioral disturbances than the no-NSSI control group (refer to Table 1 for detailed findings). Moreover, findings of this study indicate that repetitive self-injurers displayed the most pervasive disturbances. It is possible that for occasional self-injurers, their NSSI may represent early experimentation with the behaviors or simply just copy-cat cases. For repetitive self-injurers, their NSSI may reflect either (1) the existence of certain personality traits (such as behavioral impulsivity or emotional over-reactivity) that predispose them for NSSI; or (2) the existence of chronic adjustment problems (such as self-disturbances or interpersonal relationship problems); or (3) the combination of both. If that is the case, their NSSI may gradually become a habitual and automatic response. Another factor that may contribute to the maintenance of NSSI among repetitive self-injurers is that NSSI may be internally or socially reinforcing to them (Skegg, 2005). For repetitive self-injurers, NSSI may effectively help them escaping from negative experiences or generating feelings in place of emptiness, as well as serving some social functions. For occasional self-injurers,

their attempts with NSSI may be unsuccessful, which keep them from using NSSI again.

Subtypes of Self-injurers: Burners, Cutters, and Other Self-injurers

We also classified self-injurers into different subtypes based on the methods they used. Since burning causes the most severe physical pain, thus burners are classified as the most severe self-injurers group. Cutters form the next severe group. Adolescents who only engaged in biting, hitting and banging form the third self-injurer group. Results show that burners and cutters tended to function worse in most areas when compared to the milder self-injurer group, which in turn, reported higher levels of psychosocial disturbances than the non-self-injurers. These findings are generally consistent with those reported in the only previous study that also differentiated NSSI based on severity (Lloyd-Richardson et al., 2007). In that study, Lloyd-Richardson et al. classified burning and cutting as moderate/severe NSSI, and biting, punching and banging as minor NSSI according to results of an exploratory factor analysis. Their findings indicated that moderate/severe self-injurers were more likely than minor self-injurers, who in turn were more likely than non-self-injurers to have a history of psychiatric treatment, hospitalization and suicide attempt, as well as current suicide ideation. Moreover, moderate/severe self-injurers were more likely to use alcohol or drugs during their NSSI episodes. The present study went one step further in this direction and separated burners from cutters and compared their psychological characteristics. Results indicated that while both groups were more disturbed than self-injurers who just engaged in milder forms of NSSI and the control subjects, there are also important differences between the burners and the cutters. First, self-injurers who did self-burning scored the highest among all groups in

suicidal thought/attempt, suggesting the act of burning may signal a more serious intention of self-destruction. Second, burners scored significantly higher than all other groups in behavioral impulsivity, particularly in aggressive impulse and substance use. These findings suggest that self-injurers who burn themselves may represent the most disturbed subgroup and may deserve more clinical and research attention in future studies.

The Relative Importance of Different BPD Features in Predicting NSSI

Regression analyses show that all the concurrent BPD features together explained a considerable amount of the total variability in NSSI (56% in boys and 43% in girls). BPD features measured a year before could still account for about 10% of the variance in NSSI for both genders, More importantly, our findings indicated that among all the BPD features, behavioral impulsivity is the most important predictor for NSSI among adolescents. When we dropped all other BPD features and just kept the three impulsive behaviors as predictors in another regression analysis, they captured almost the exact amount of variance in NSSI as when all predictors were used in the equation (55% for boys and 43% for girls). This finding is also replicated in the selected group of adolescents with significant BPD pathology (54% of the variance when all predictors were entered in the equation vs. 52% when only the three impulsive behaviors were used as predictors). These findings clearly indicate the importance of behavioral impulsivity in predicting NSSI among adolescents.

Our findings of strong and robust associations between NSSI and other impulsive behaviors suggest that there may be a general trait of behavioral impulsivity underlying the development of different impulsive behaviors. This line of

thinking is consistent with the concept of "multi-impulsive personality" proposed by Lacey and Evans (1986). Based on clinical observations, these researchers suggested that patients with alcohol and substance abuse, multiple overdoses, repetitive self-damage, sexual disinhibition, shoplifting, and binge eating might form a unique "multi-impulsive personality" group. These people are characterized not just by one specific symptom but by multiple impulsive behaviors. Other researchers have also emphasized the importance of impulsivity in NSSI (e.g., Favazza, 1998; Favazza & Simeon, 1995). Favazza and Simeon (1995) actually argued that repetitive impulsive self-injury should be classified under "impulse control disorders not elsewhere classified". This argument echoed Lacey and Evans (1986)'s observation that NSSI should not be separated from other impulsive behaviors. Research on NSSI in the past decade, however, has seldom examined the role of behavioral impulsivity in the development of NSSI. Many studies focused on exploring the functions of NSSI. The functional model of NSSI suggests that people use NSSI to serve certain functions, such as to relieve negative emotions, to stop painful dissociation, or to achieve certain interpersonal goals (Nock, 2008). Our findings clearly indicate the importance of behavioral impulsivity in the development of NSSI, and the existence of multiple impulsive behaviors represents a robust risk marker for NSSI. Exploring the potential moderating role of behavioral impulsivity within any functional model may be a fruitful direction in future research.

The Relative Importance of Different Impulsive Behaviors in Predicting NSSI

In this study, we also examined the relative importance of different impulsive behaviors in predicting NSSI. The three impulsive behaviors, in combination, accounted for a significant amount of shared variability in NSSI (29% among boys

and 23% among girls). This finding reflects the important role of a global impulsive trait in predicting NSSI.

Our findings also indicated that among the three types of impulsive behaviors, substance use accounted for the largest amount of unique variance in predicting NSSI (24% among boys and 16% among girls). Moreover, findings of the logistic regression also indicated that T1 substance use would double the risk of later and continuing engagement in NSSI, and reducing the level of substance use would halve the risk of continuing engagement in NSSI. Our finding that substance use seems to play an important role in the occurrence of NSSI is consistent with numerous findings from previous studies (refer to studies reviewed in Table 1). Substance use may enhance the risk for NSSI through several mechanisms. First, many substances result in substance-induced dysphoric mood and therefore may increased psychological distress. Second, many psychoactive substances are known to impair cortical inhibition ability in human and therefore increase impulsivity and aggressiveness (Moeller & Dougherty, 2002). Thus, individuals with increased substance use would have more difficulty in suppressing inappropriate impulse, such as the urge to conduct NSSI. Third, substances can have many negative effects on cognitive processes, such as constricting attention and inhibiting the generation and effective implementation of coping strategies that might otherwise forestall NSSI (Hufford, 2001).

The Development of NSSI in an Interpersonal Context

The present study also tested three path models on the development of NSSI. The best fitting model indicates that unstable mood and unstable sense of self among adolescents resulted in unstable relationship, and unstable relationship, in turn,

triggered NSSI. In this model, unstable mood and unstable sense of self accounted for 50.9% of the variance in unstable relationship, and the three antecedent variables accounted for only 7.2% of the variance in NSSI. These findings suggest that adolescents with unstable mood and an unstable sense of self tend to develop more unstable interpersonal relationships, and frequent interpersonal problems such as being rejected or abandoned may trigger NSSI in some vulnerable adolescents. Our finding that interpersonal problems may trigger NSSI in some adolescents support Hilt, Cha and Nolen-Hoeksema (2008)'s observation that interpersonal distress was associated with NSSI in adolescent girls.

The present study also examined the moderating role of behavioral impulsivity in the development of NSSI. Results reveal that the absolute magnitude of the path from unstable relationship to NSSI is 7.5 times larger for high impulsive adolescents than for low impulsive adolescents. Thus, the absolute magnitude of the moderation effect is appreciable (Chaplin, 1991). Also, the variance in NSSI accounted for by the interpersonal model is about 3.4 times as large among high impulsive adolescents as among low impulsive adolescents (6.4% vs. 1.9%, respectively). These findings reflect the importance of exploring the moderating role of behavioral impulsivity in the development of NSSI. Future research testing the functional model of NSSI should incorporate behavioral impulsivity and further examine its potential moderating effects.

Strengths and Limitations of the Present Study and Future Directions

There are several strengths in this study. First, as a prevalence study, the large sample size enhances the reliability of our findings. Second, our study includes longitudinal data and provides important information on the over time relationships

between BPD features and NSSI. Third, the present study reveals the strong association between NSSI and behavioral impulsivity, which has been largely neglected in previous NSSI studies among nonclinical samples. The view that NSSI and other impulsive behaviors may represent different phenotypic expressions of a common underlying trait of behavioral impulsivity, if proven, may lead future research to a new and more fruitful direction.

Despite the strengths, some limitations of the present research should be noted. First, the assessment of NSSI was based on self-report measures. Although this is more convenient, cost-effective and time-saving in estimating the prevalence of NSSI among a large community sample, individual interviews may provide more information on the reasons why they do self-injury, the feelings they experience when they conduct NSSI, the severity of their NSSI, as well as their underlying emotional disturbances. Second, our sample of school adolescents may not be fully representative. It is possible that school drop-outs may contain more adolescents engaging in NSSI. Future studies examining NSSI behaviors among school drop-outs may be fruitful. Third, we measured the five specific NSSI behaviors only in Time 2. This prevents us from following the change of individual NSSI behavior. Fourth, we included the same set of variables in the analyses for identifying both risk factors and protective factors. Although substance use emerged as both a risk factor and a protective factor, protective factors may not simply be the inverse of risk factors (Skegg, 2005). It is helpful for future research to examine if other variables such as social support and religion affiliation could protect adolescents against engaging in NSSI.

Clinical Implications

Notwithstanding the limitations, findings of the present study have some significant clinical implications. First, NSSI is relatively common among Chinese adolescents. About 15% of them reported engaging in NSSI in the past two years. This suggests that clinicians working with adolescents should routinely assess for the presence of NSSI. Moreover, NSSI often reflects the existence of multiple underlying problems across various domains. Despite its clinical significance, NSSI has not received enough attention in the Chinese society. Schools, families, and communities should work together to develop a comprehensive mental health intervention program for adolescents with NSSI.

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